the OIL AND GAS JOURNAL

NOVEMBER 11, 1957

PRE-A.P.I. ISSUE

Oil Looks Ahead

Soaring demand will require . . .

More drilling . . . Greater reserves . . . Higher imports . . .
Shifts in refinery processing . . . A lot more money p.135

ALASKAN REPORT:

Three Wells Drilling, More Due

p. 116

What's Happened to Butadiene

Beginning a five-part series. p. 166

8 *times through the earth...equals*

338,000,000 feet of solid oil well protection cemented by Halliburton during the past twenty years... in all oil producing areas of the free world... through all types of formations... regardless of depth or varying well conditions.

HALLIBURTON OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

"CONTINUOUS AID TO MODERN PETROLEUM TECHNOLOGY"

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Nov. 11, 1957

Some 1958 model cars are putting refiners on a spot:

Many of the new cars will need every bit of the quality built into new 100-octane motor fuels, a Sun Oil research executive warns.

Dr. Charles L. Thomas predicts: All signs still point to continuation of the trend toward greater power and higher compression ratios. This means many more billions will be needed in years ahead in processing to keep up with demand for more and better motor fuels.

Ford is trying to top other makers in its economy pitch. In 1958 it will stress that all Ford models except the top 300-hp. job will operate on regular-grade gasoline. In 1957 Ford recommended premium for all models.

Automotive engineers still are on notice that the present spark-ignition engine needs improving. Goal still is better efficiency and economy.

That was keynote of Horning memorial lecture of John M. Campbell, General Motors scientific director, before S.A.E. Significantly, he made no mention of the gas-turbine or free-piston engines in our automotive future.

Campbell also called for spectacular technical breakthrough to supplant our present wasteful heat engines. He cited need for commercial use of electrochemical or thermoelectric processes.

Mark this down as another hint at future possibility of the so-called "fuel cell" which converts chemical energy directly to electrical energy.

One-third of U. S. service stations lose money after deducting salaries.

Dun & Bradstreet survey of 516 stations over country also found: Average operator earns $6,606 in salary a year plus about 1 per cent profit before taxes on $89,265 worth of business...Midwest operators do best, Far West worst...Highway stations do less business than downtown or neighborhood locations but have lower costs.

State-of-the-industry reports now being received by oil-company stockholders carry this common analysis:

Third-quarter declines are attributed to substantial cuts in domestic production allowables, sharp declines in margin between selling prices of products and purchase price of crude, an industrywide 6 per cent wage increase, and a lower than expected demand.

Even companies which show nice profits are complaining of the smaller profit margins for the refining segment of industry.

A long-range national policy on oil in defense may emerge from a study just started.

ODM Chief Gordon Gray, who is directing the work, says it's the first such study. He has experts of ODM, Defense, and Interior digging up background facts. Meetings have been held with oil company officials. Talks centered on means of getting data basic to a new policy. No program has yet been worked out.

Final recommendations on a policy will include:

...Military estimates of duration and type of any war.

...Reassessment of petroleum requirements, the availability and transportability of crude and products.

...Role of imports should domestic installations suffer damage from attack.

One of the most complex secondary-recovery projects ever attempted is in prospect in Seeligson field, South Texas.

Mammoth program now before Texas Railroad Commission calls for simultaneous pressure-maintenance or cycling operations in 18 separate reservoirs. The tough project is expected to hike oil recovery from the 14,240-acre unit by more than 60 million barrels.

Oil men are watching Dominion Oil's wildcat off Trinidad.

It may be the first oil well ever drilled over water from a nonstationary drilling device. California operators have been drilling core holes from floating barges for more than a year. A Gulf Coast operator plans to use a similar technique to drill for oil, but Dominion may have stolen a march.

Dominion's Couva Marine 1 was below 1,000 ft. last week. It is being drilled in 40 ft. of water, 4½ miles off the west coast of Trinidad. Location is 32 miles northeast of Trinidad's only offshore field and 45 miles northeast of Gulf of Paria drilling locations.

Strong upsurge in foreign exploration work is reflected in report of Seismograph Service Corp.

Company had a 32 per cent increase in net profits for first 9 months of 1957.

Foreign seismograph activity is reported excellent in Mexico, Venezuela, Colombia, Bolivia, Canada, and Libya.

Tracers added to cement are proving a cheap way for producers to find where water is entering oil and gas wells.

The method is used during completion or workovers.

Here's how it works: Water moving over a cement surface erodes away minute particles of material. These can be identified by microscopic analysis (p. 163).

For refiners a big question now: Is radiation processing going to live up to its promise?

It's still too early to say. But there have been some disappointing disclosures recently. High hopes were held that bombarding hydrocarbons by nuclear radiation would bring out certain reactions to exclusion of others. This hasn't been true. Many reactions which couldn't be controlled resulted.

But radiation plus catalysts may prove helpful.

Early work by Gulf on isomerization of pentane absorbed on various catalysts shows the isomer yield increased in the presence of a radiation field. This phenomenon occurred only on certain catalysts. It is most pronounced when catalysts are in a fine state of subdivision.

Refiners can expect some important new data on static electricity next week.

The subject will get its first major airing at Chicago sessions of the A.P.I. Some new insight into this widespread problem in handling petroleum fractions along with suggestions for control will be announced.

New class of phosphorous gasoline additives, said to be better than any others, is attracting attention.

Two phosphines—tri-n-butyl phosphine and triethyl phosphine—do the same job of reducing spark-plug fouling and preignition in high compression cars.

Sinclair research teams report in contrast to other phosphorous compounds they reduce octane requirement buildup instead of aggravating it.

Need to cut acid losses? General Petroleum has found one answer at its Torrance, Calif., refinery.

It's a refrigeration unit added to acid-recovery system of an HF alkylation plant. Initial operations indicate lower losses will pay out the unit in 2½ years (p. 172).

Free-piston engine is making good on its first commercial use in the U. S.

General Motors Diesel Division put one in Liberty Ship William Patterson. The ship's 6,000-hp. engines used half a barrel of low-grade fuel oil for each mile. That's competitive with present-day oil-fueled cargo ships.

G.M. believes multiples of 1,000-hp. unit up to 15,000 or 20,000 hp. will be feasible and economical for large ships.

It's time to take a serious look at a shorter work week, says O. A. Knight, president of Oil, Chemical and Atomic Workers.

Union leadership fears possible large future layoffs in the oil and chemical industries due to new equipment, automation and general business conditions.

Knight isn't ready to recommend negotiations for shorter week. He thinks union and employers should study standby clauses in contracts calling for shorter hours as alternative to layoffs.

Talk of a Suez pipeline is being revived.

Lebanese financier Emile Bustani talked late last month with British oil interests in London about a line paralleling the Suez Canal. Earlier he talked with American oil officials in New York and Washington. These huddles followed the break down of Onassis-Egyptian talks about a $280-million line in the same area.

Bustani also laid another project before the oil heads: An Arab Oil Investment Bank similar to the World Bank. It would be financed by a 5 per cent levy on gross profits from Middle East production with Iran excepted.

Levy would yield about $84 million a year. Funds would be spent on development projects in "oil-transit countries," such as Egypt, Syria, Lebanon, and Jordan.

New trend in gas contracts may be developing.

Consolidated Edison of New York and Long Island Lighting have gone directly to producers for 75,000 M.c.f. daily to be transported by Transco.

This deal has advantages to producers and distributors: Price is less likely to become an issue before FPC. Distributors don't have to depend on transmission companies to buy enough reserves to meet increasing demand. Distributors and transporters have a simple transit agreement. Distributors know what prices will be. The middle man is eliminated on gas purchases and sales.

Home Oil really showed faith in Trans-Canada's future in recent deal to get stock owned by T.G.T. and Hudson's Bay.

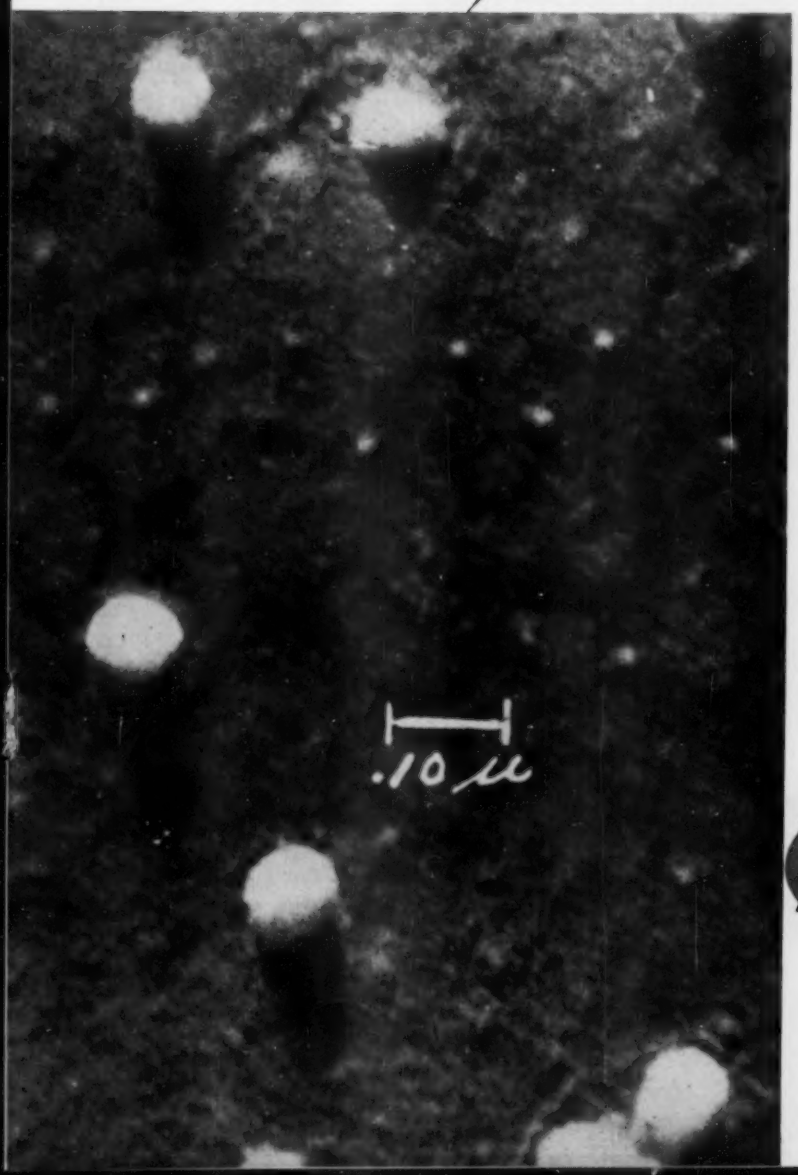
Home reportedly traded oil and gas reserves in Pembina, Harmatten, and Nevice fields for additional T.G.T. shares. It paid 50 to 75 per cent above quoted market price for stock of Hudson's Bay. Deals gave Home 12 per cent of Trans-Canada with options to increase this to 16 per cent ownership.

Possibility of importing foreign crude over St. Lawrence seaway to midwestern refiners looks less attractive.

Reason: Tolls may be higher than expected. The seaway authorities now plan to charge tolls high enough to cover additional expenses as well as the original cost of the seaway project.

MEASURING THE UNSEEN

Influenza virus magnified 78,570 times by an electron microscope. The unit of measure shown, 0.1 μ, is 1/10,000 millimeter.



Tuboscope research in its field has been as imaginative and rewarding as the electron microscope has been in its field.

With instruments developed by Tuboscope research, Tuboscope technicians are able to measure the unseen ravages of wear, fatigue, and corrosion in oilfield tubular goods. These instruments, coupled with Tuboscope's years of experience, assure you of the best and the newest in proved methods of non-destructive inspection in the field.

The important elements of bottom hole temperature and pressure can likewise be measured by the Subsurface Engineering Division.

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The OIL AND GAS JOURNAL

NOVEMBER 11, 1957 • VOLUME 55 • NUMBER 45

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

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TECHNOLOGY—OPERATION

Pipelining

Two-Phase Pressure Drop In Inclined Pipelines 145

By W. E. Brigham, E. D. Holstein, and R. L. Huntington

Here are some experimental results in an area of pipelining where little is known. Results show that flow patterns are similar to those reported by other investigators for horizontal flow. However, stratified flow was not found at all in the inclined system.

Two-Phase Flow In Gathering Systems 150

By Ovid Baker, Magnolia Petroleum Co.

This article translates the experimental results of the preceding article into field practice. Results may make possible more precise design calculations for two-phase pipelining.

Corrosion of Oil-Industry Storage Tanks 153

By J. S. Hume

Pipeline-Construction Report 199

Refining-Processing

Corrosion of Oil-Industry Storage Tanks 153

By J. S. Hume

This is the report of a panel from the A.P.I. subcommittee on corrosion. First part of the article gives results of a survey on tank corrosion and the second section is a selected bibliography of tank corrosion articles and abstracts of them.

What's Happening to Butadiene 166

By John C. Reidel

In the few years under private ownership, present and projected capacity of butadiene has almost doubled to over 1,000,000 short tons annually. This installment, Part 1 of a five-part series, will bring the reader up-to-date on recent progress in this field.

Propane Chiller Cuts Alky Unit Acid Losses 172

By D. H. Stormont

Acid savings indicate a 2½-year payout.

On The Job . . . In The Plants 176, 189

New drilling program allows employes to advance on merit—Ground-temperature recorder can be used to determine when to light well heaters—Automatic alcohol-injection system prevents wet-gas line plugging.

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Questions on Technology 194

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Cement Tracers Help Find Water Leaks 163

By D. H. Stormont

Tracers added to cement during completion and remedial work are proving to be a rapid, low-cost means for determining the source of water entry into oil and gas wells.

New Latex Cement Successful for Oil-Field Work 174

An analysis of 866 jobs with a new latex cement shows an over-all success ratio of 75.8 per cent in areas where regular cement gave poor results or failed completely.

Reservoir Performance By Nomograph 178

By Ira B. Dye

This method enables the solution of a trial-and-error material balance prediction by use of a set of nomographs constructed for the specific reservoir operating under solution-gas drive.

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UNRETOUCHED PHOTOGRAPH OF PRIMARY FORGING

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THESE ARE BUT *TWO* OF THE FEATURES IN THIS NEW NORRIS TECHNOLOGY. OTHERS WILL BE DESCRIBED IN SERIES TO FOLLOW.

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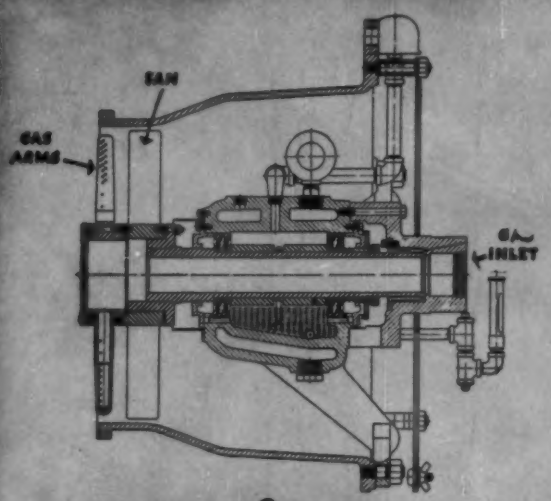

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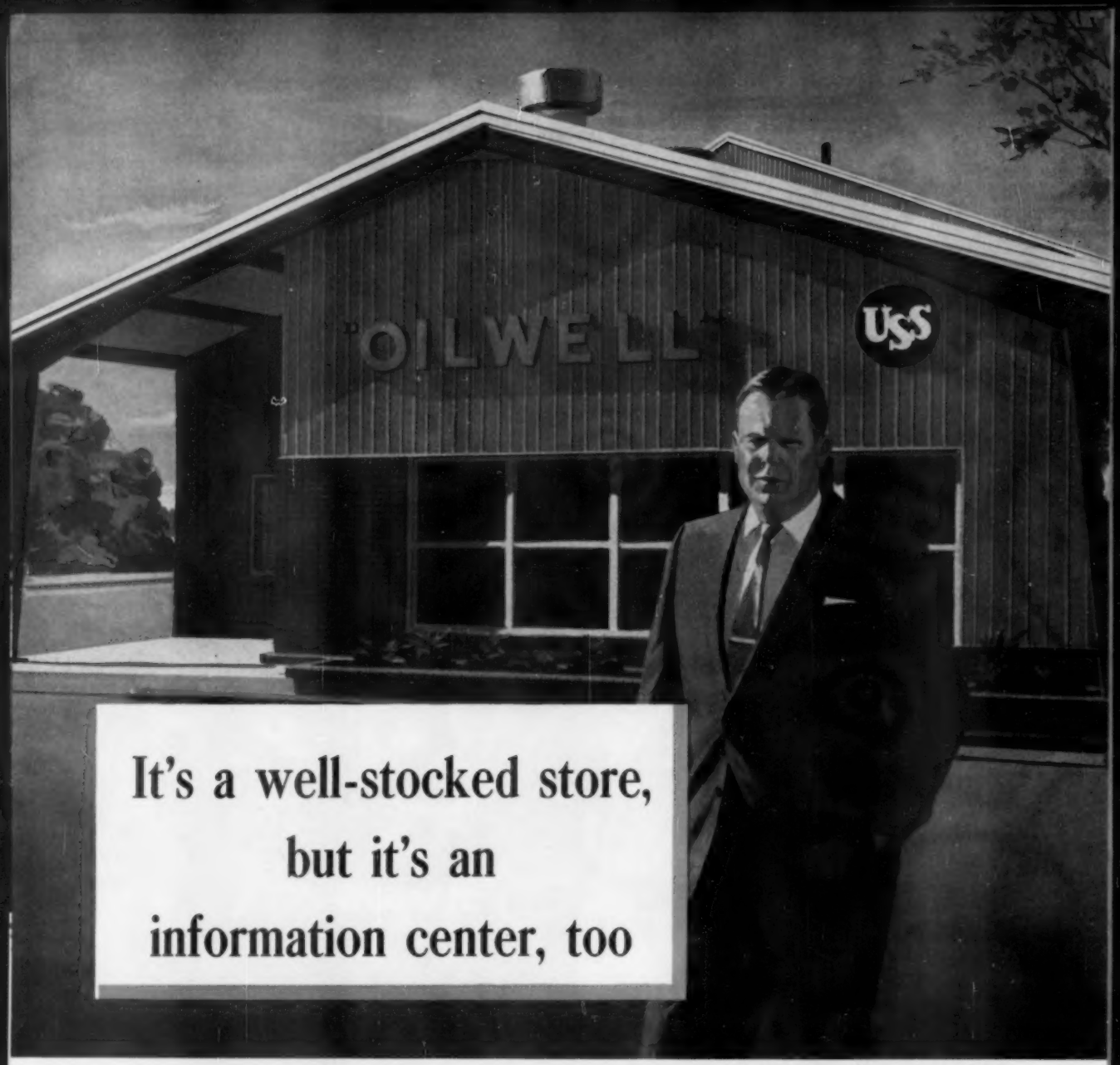

It's a well-stocked store, but it's an information center, too

The "Oilwell" store in Big Spring, Texas—Frank Mobley, Manager

WHEN anyone says "general store," most of us think of the old country store where you could poke around and look at things, and meet with other people. Thus, the general store was an *information center* – a place where you could learn things.

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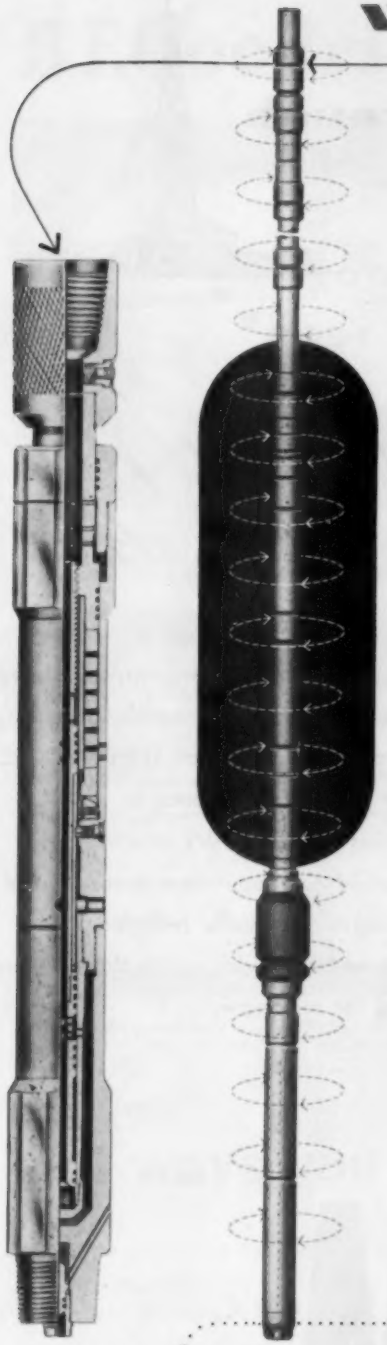

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News about

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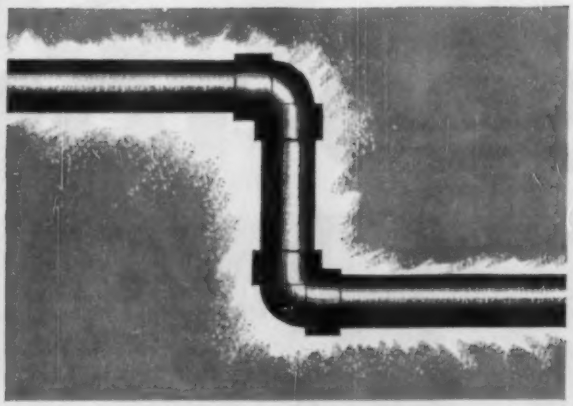

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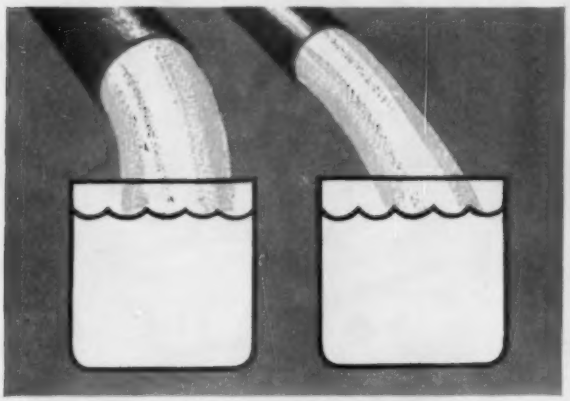

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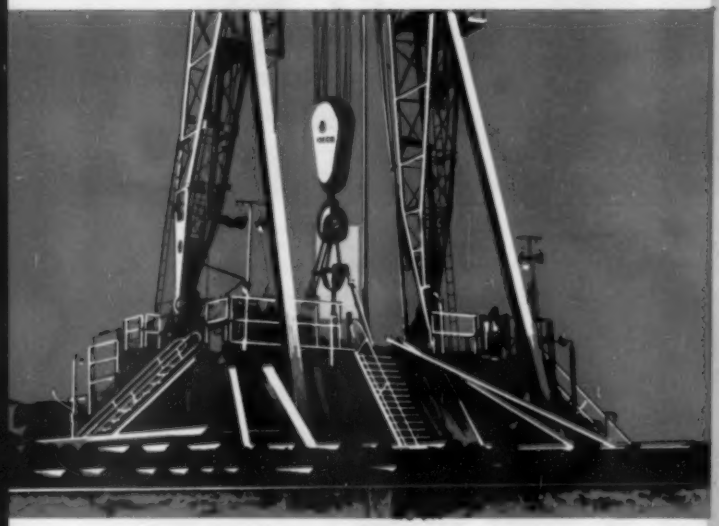

ENGINEERED BALANCE AND TRUE ALIGNMENT GIVES EXTRA LONG LIFE

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Good looking swivel, isn't it? The inside story is equally impressive. Only Ideco has all these advanced features: Rapid hose coupling, Kwik-Change "Floating" washpipe assembly, four-bearing design with adjustable clearance main bearing, streamlined all-steel body, low center of gravity. Write for complete information.

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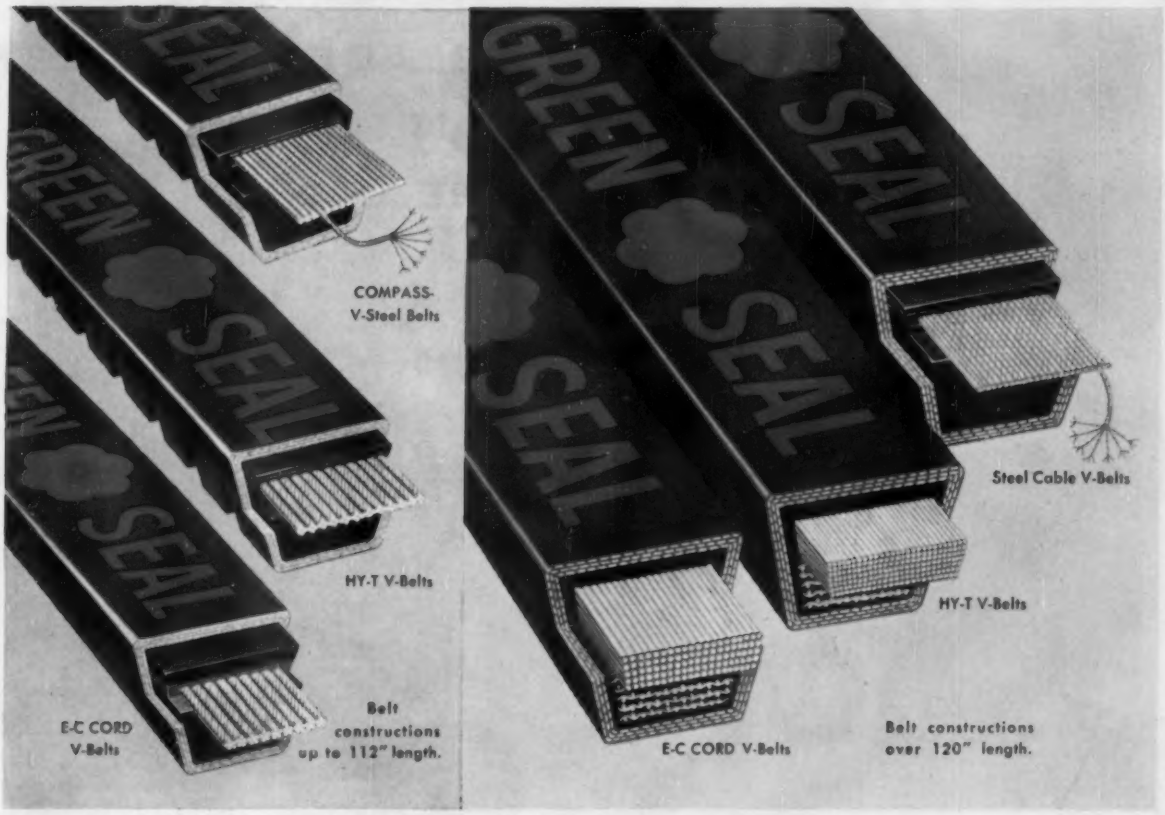

Until recently dimensional stability was possible only in V-Belts with steel load-carriers as developed by Goodyear. But now you can have that stability in a complete line of belts – thanks to the development of Triple-Tempered (3-T) cord–synthetic cord tempered by Tension, Temperature and Time.

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When you're belting multiple drives, it's your one guarantee that every set of matched belts will *really* match. No matter how long you store them, they'll *stay* matched, too.

And once they're installed, you've got belts designed and built to work as a perfect team–without individual belts either "loafing" or overworking. In fact, you're protected from all the usual mismatching headaches that also include slipping, stretching, scorching.

In other words, you're belted for maximum trouble-free horsepower hours at minimum cost. There's no substitute for that kind of performance – or for the V-Belts with the Green Seal that give it to you – every time.

So see your dealer about the V-Belts with true dimensional stability–the V-Belts with the Green Seal. Or write Goodyear, Industrial Products Division, Lincoln 2, Nebraska, or Akron 16, Ohio.

DIMENSIONALLY STABLE V-BELTS
with the GREEN SEAL by

GOODYEAR

THE GREATEST NAME IN RUBBER

Compass, E-C Cord, Hy-T, Green Seal–T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Watch "Goodyear Theater" on TV – every other Monday 9.30 P.M., E.S.T.

HOMCO HAS IT!

THE HOMCO REPLACEABLE BLADE STABILIZER AND STRING REAMER

Mr. Toolpusher:

The Homco Stabilizer allows normal drilling weight on the bit to permit faster penetration for vertical hole drilling, and insures that the angle of the bore-hole is kept well within contract limits.

The Homco Stabilizer is used extensively in Directional Drilling to stabilize the drill collar section for maintaining a desired direction and angle. The stabilizer prevents drill collar wall sticking and eliminates the danger of pulling drill collars into a key-seat. The Homco Stabilizer is your most economical insurance against the hazards encountered in crooked and straight hole drilling.

Where the formations are extremely difficult, we recommend the use of Homco Klustrite® blades. The blades can be changed on the rig floor in a matter of minutes.

Write for technical bulletin

THE WORLD'S LARGEST INDEPENDENT OILFIELD SUPPLY AND SERVICE ORGANIZATION

DIRECTIONAL DRILLING • FISHING AND CUTTING • OILFIELD SUPPLIES • ELECTRICAL WELL SERVICE

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HOUSTON OIL FIELD MATERIAL COMPANY, Inc.

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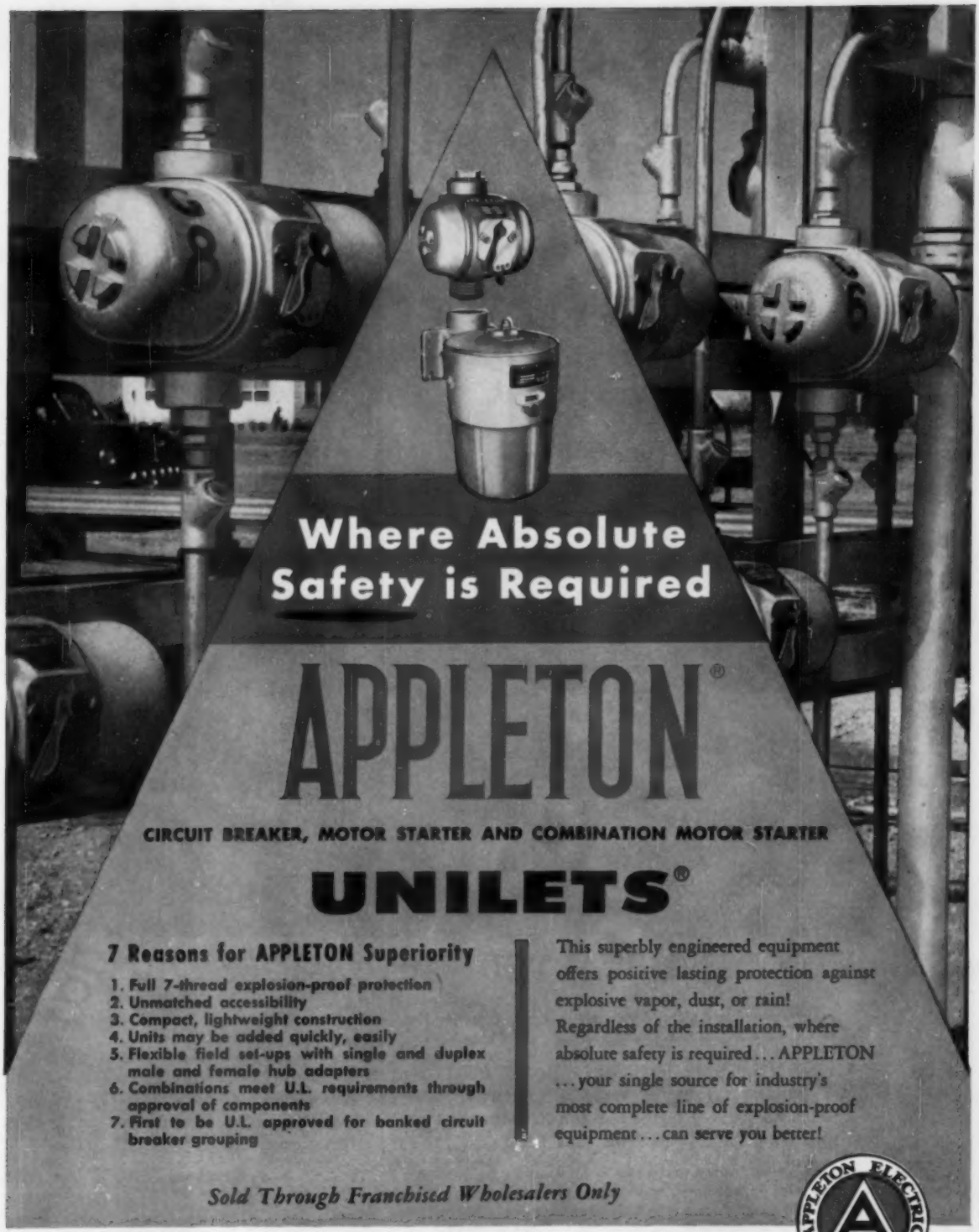


Where Absolute Safety is Required

APPLETON®

CIRCUIT BREAKER, MOTOR STARTER AND COMBINATION MOTOR STARTER

UNILETS®

7 Reasons for APPLETON Superiority

1. Full 7-thread explosion-proof protection
2. Unmatched accessibility
3. Compact, lightweight construction
4. Units may be added quickly, easily
5. Flexible field set-ups with single and duplex male and female hub adapters
6. Combinations meet U.L. requirements through approval of components
7. First to be U.L. approved for banked circuit breaker grouping

This superbly engineered equipment offers positive lasting protection against explosive vapor, dust, or rain! Regardless of the installation, where absolute safety is required... APPLETON ...your single source for industry's most complete line of explosion-proof equipment... can serve you better!

Sold Through Franchised Wholesalers Only

APPLETON ELECTRIC PRODUCTS®

Also Manufacturers of:

Explosion-Proof Fixtures

"ST" Series Connectors

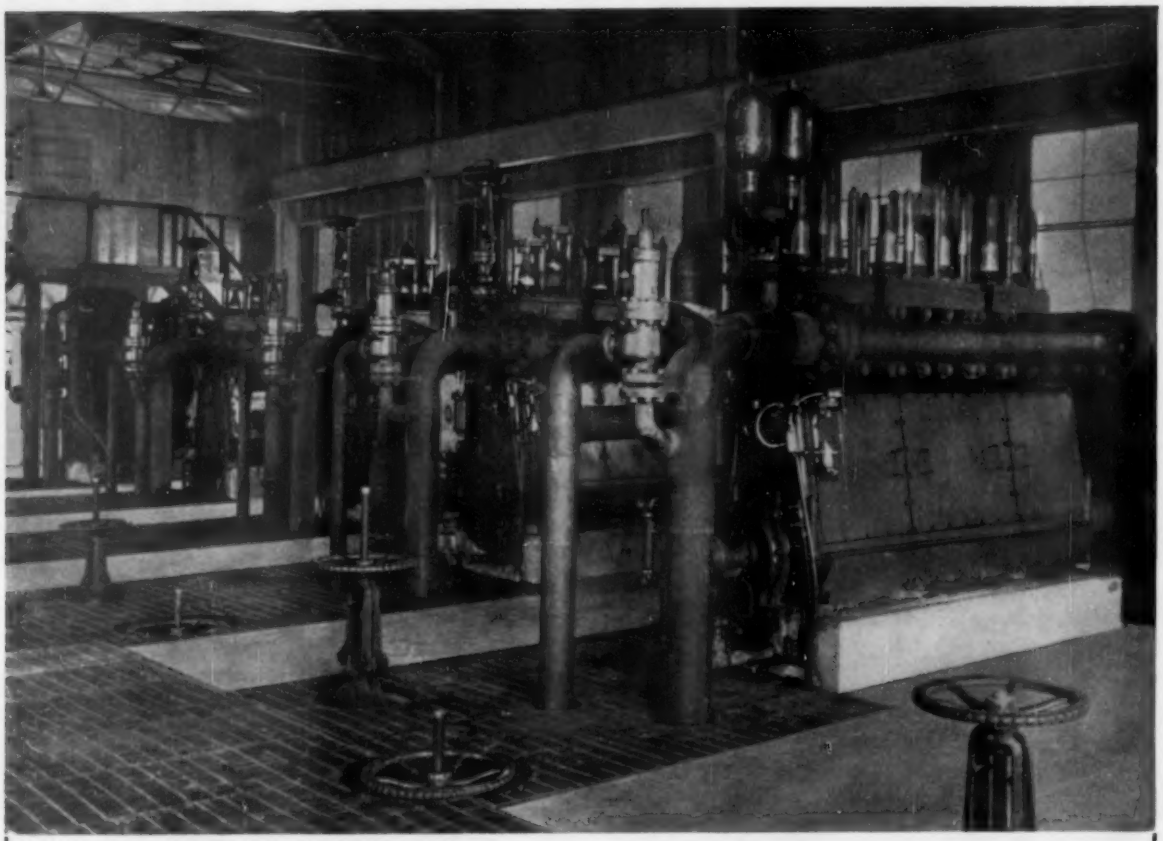
Automatic Reelites

Industrial Lights

Outlet Boxes

Rely on APPLETON... the Standard for Better Wiring®

APPLETON ELECTRIC COMPANY • 1719 Wellington Avenue • Chicago 13, Illinois



FIELD REPORT

FLOOD: Salem Unit

PUMPS: 10 Aldrich Pumps

2 Variable Stroke, 2 Triplex, 2 Quintuplex, 4 Septuplex

FLOODING STARTED: April 1953

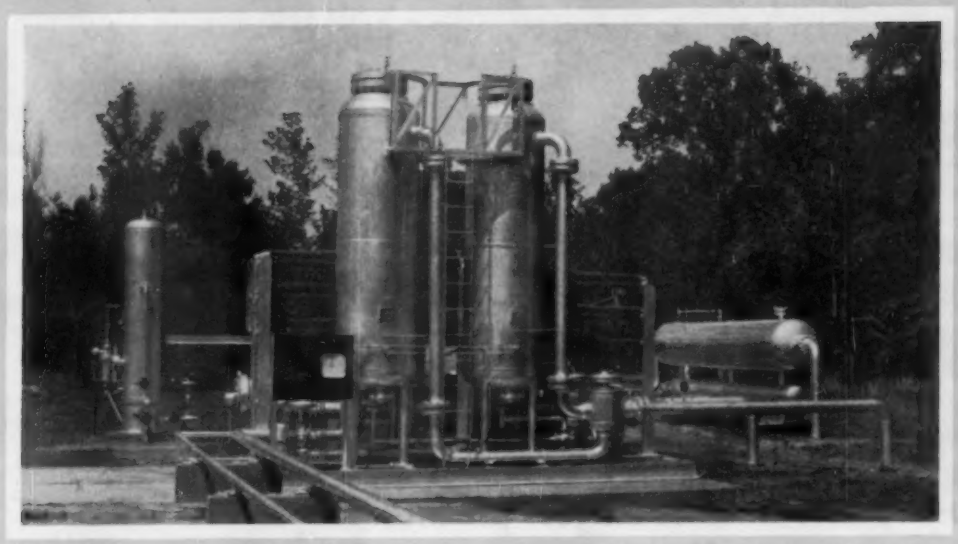
EXPERIENCE TO DATE:

Pumps operating currently under 800 lb pressure, delivering 171,000 bbl a day. Handle mixture of fresh water and oil field brine. Routine maintenance every 4000 hours. Customer reports pump operation and Aldrich field service "satisfactory."

Field parts stock available in Carmi, Ill.; Charleston, W. Va.; Houston; Los Angeles; Odessa and Tulsa. For further information, write the Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.

the toughest pumping problems go to ALDRICH

HOW TO GET ADDITIONAL RECOVERY FROM SMALL VOLUME GAS STREAMS— DRYEX®



The efficient, profitable recovery of raw gasoline from gas streams of 5-50 million cu. ft. per day volume is now provided by "Dryex", a completely automatic, skid-mounted adsorption process unit developed by Delta.

The "Dryex" unit affords safe, reliable recovery of 85% of the commercially valuable liquids in such gas streams, at an average operating cost of approximately 15¢ per barrel. "Dryex" may also be used profitably on large, rich gas flows.

For full information regarding "Dryex" and other units in Delta's modern line of oil field equipment and pressure vessels for the chemical, petro-chemical and petroleum industries, *ask the Delta man.*

Ask the Delta man at the A.P.I. Convention!

DELTA TANK MANUFACTURING COMPANY, INC.
BATON ROUGE, LOUISIANA
PLANTS: BATON ROUGE, LA. • MACON, GA. • BEARDSTOWN, ILL.
EXPORT OFFICE: INTERNATIONAL TRADE MART, NEW ORLEANS, LOUISIANA
FABRICATORS OF OIL FIELD EQUIPMENT, MATERIAL HANDLING EQUIPMENT, AND PRESSURE VESSELS.

ENGINEERS: Desirable positions available at Delta Tank for engineers and skilled mechanics in many categories. Address inquiries to Employment Manager.

ACCO
for Better Values

American Cable
TRU-LAY VHS WIRE ROPE
15% STRONGER

Tru-Lay VHS lines of longest practical length plus proper cut-off practices...
The key to longer, safer rotary line life

• No matter what wire lines you are using, there are right and wrong ways to operate them.

TRU-LAY VHS Lines are made of tougher—wear-resistant, high tensile steel—15% stronger than Improved Plow Lines.

Purchasing the longest practical length permits making the greatest number of cuts before having to discard the line completely.

Cut-off schedules can be adjusted to take advantage of the added serviceability of the VHS Lines.

TRU-LAY VHS Lines provide the highest factor of safety of any line on the market during its entire period of service. These advantages become increasingly apparent when drilling at depths beyond 10,000 ft.

Our field representatives are available to assist you in recommending the best cut-off practice for your lines and we will be pleased to supply you with a Ton-Mile Record Book containing reference tables and forms especially designed for this purpose.

American Cable Division
AMERICAN CHAIN & CABLE
Bridgeport, Conn.
Factories at Wilkes-Barre, Pa., and Houston, Texas

ACCO
A C C
TRADE MARK

Portable gas products plant

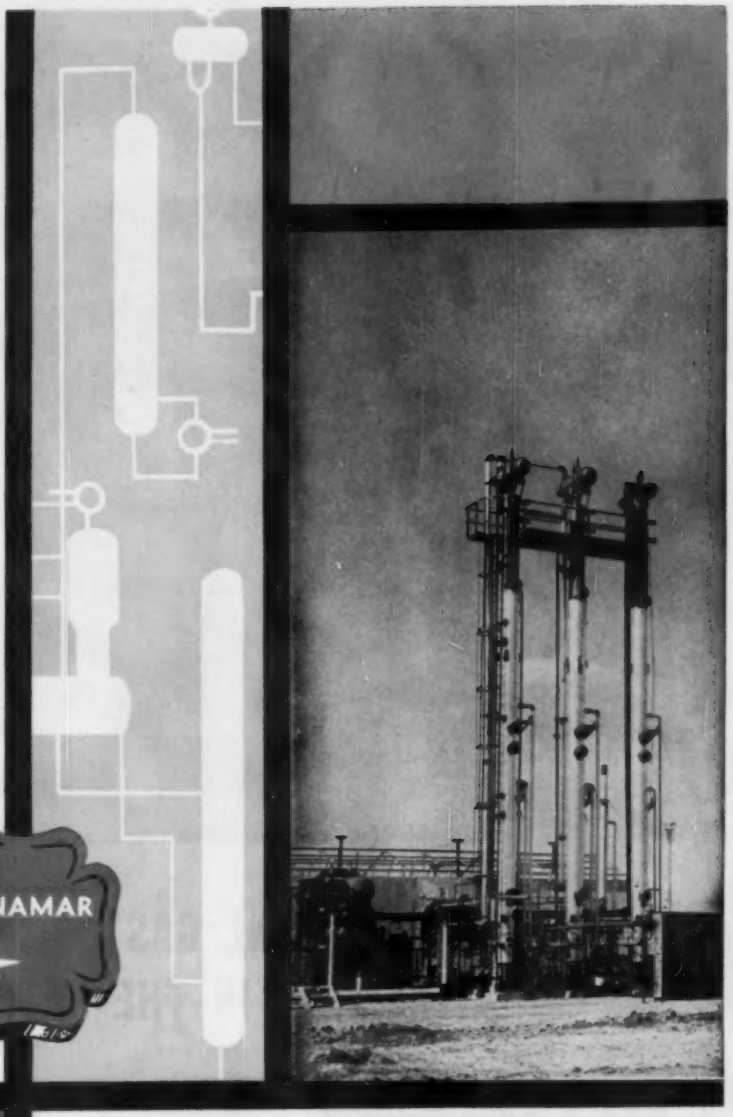
The McNamar Portable Gas Products Plant offers the operator the most economical means of producing Propane, Butane, Natural Gasoline or Stabilized LPG.

The plant pictured is an automatically operated straight refrigeration process and is skid-mounted to insure a low field installation cost.

Another prominent cost saving feature of the plant is it's complete portability . . . if moved to a new location, up to 85% of your original investment can be recovered.

McNamar plants are also designed on oil absorption and combination oil absorption and refrigeration processes. Designs are dependent upon overall economics and percent recoveries.

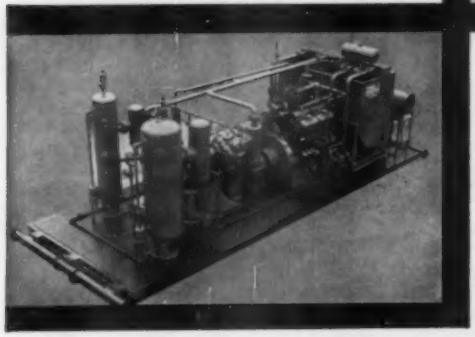
Call, write or wire Gas Products Division of McNamar Boiler and Tank Company for further information.



McNAMAR

Desulphurization Plants

Glycol and Solid Desiccant Dehydrators



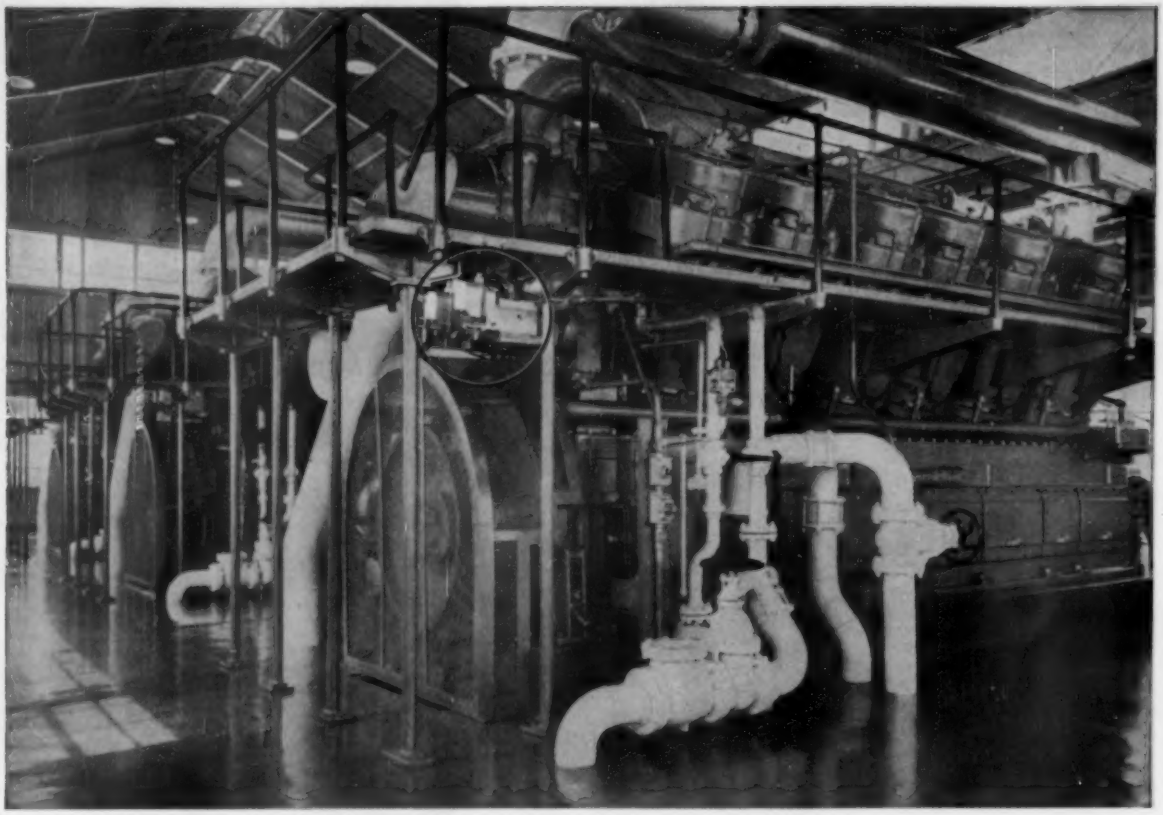
Compactness, portability and versatility are symmetrically designed into the McNamar Joy WNB 112, 200 horsepower, twin cylinder Gas Compressor. The completely packaged units are easily installed and economical to operate.

The McNamar-Joy Gas Compressor units may be engineered to your application and are available on purchase, rental and rental-purchase option basis. 50, 100, 200 and 400 horsepower sizes are also available.

McNAMAR TULSA

McNAMAR BOILER & TANK CO.

BOX 868 — TULSA, OKLAHOMA CHerry 2-6291



SERVING TRUNKLINE GAS COMPANY OF HOUSTON —A VITAL LINK IN THE NATION'S ECONOMY!

Matched Ignition System

Trunkline Gas Company of Houston, Texas, operates a natural gas transmission line extending from near McAllen, Texas, to Tuscola in central Illinois where it connects with the line of the Panhandle Eastern Company.

This gas line crosses Texas, Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, and the southern half of Illinois —a vital link in the nation's economy.

Helping to serve this very important segment of the nation's natural gas transmission system is the battery of Ingersoll-Rand 412 KVS engines equipped with Bendix DLC6 magnetos and Bendix HI-V transformer coils (illustrated at left) in Trunkline's Cypress Compressor Station near Houston.

The Bendix DLC6 magneto is a completely new type of magneto, incorporating the latest engineering design. Together with the Bendix HI-V transformer coil it becomes a matched ignition system that delivers more than ample voltage with greatly reduced maintenance cost.

SCINTILLA DIVISION OF BENDIX AVIATION CORPORATION, SIDNEY, N. Y.

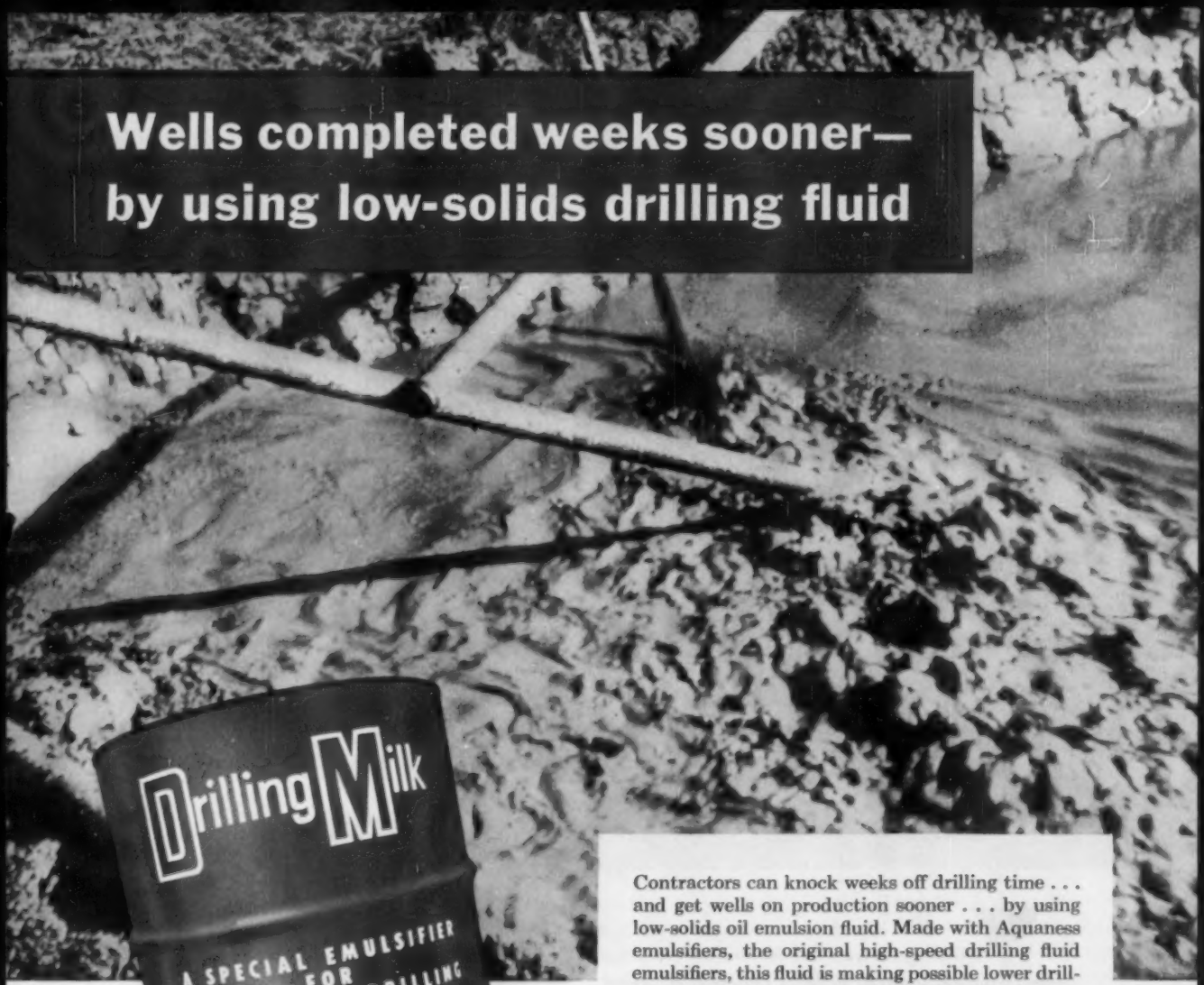
Export Sales and Service: Bendix International Division, 205 East 42nd St., New York 17, N. Y.
Canadian Affiliate: Aviation Electric Ltd., 200 Laurentien Blvd., St. Laurent, Montreal 9, Quebec

FACTORY BRANCH OFFICES: 117 E. Providencia Avenue, Burbank, California • 545 Cedar Lane, Teaneck, New Jersey • Paterson Building, 18038 Mack Avenue, Detroit 24, Michigan • 5906 North Port Washington Road, Milwaukee 17, Wisconsin • Hulman Building, 120 West Second Street, Dayton 2, Ohio • 2608 Inwood Road, Dallas 19, Texas • Boeing Field, Seattle 8, Washington • 1701 "K" Street, N. W., Washington 6, D. C.

Scintilla Division
SIDNEY, N.Y.

Bendix
AVIATION CORPORATION

Wells completed weeks sooner— by using low-solids drilling fluid



Contractors can knock weeks off drilling time . . . and get wells on production sooner . . . by using low-solids oil emulsion fluid. Made with Aquaness emulsifiers, the original high-speed drilling fluid emulsifiers, this fluid is making possible lower drilling bids, with fair profit to contractors. It has been used with outstanding results in over 500 wells.

PENETRATION RATES INCREASED. Tests on offset wells show low-solids fluid boosts penetration rates from 26 to 41%.

TRUER GAUGE HOLE DRILLED . . . less cement required.

MUD CONTROL SIMPLIFIED. Solids drop out quickly. No foaming. Minimum mud service. Mud flows like water; viscosity can be easily controlled. Faster mud conditioning.

LOST CIRCULATION REDUCED. Weights are lighter; pressures are lower.

LARGER CUTTINGS. Better for geological analysis.

SALT AND AIR CORROSION RETARDED by excellent inhibiting properties of this fluid.

ASK YOUR MAGCOBAR DEALER ABOUT DRILLING MILK*

. . . or write to Magcobar about this emulsifier for low-solids fluids.

*Trademark Magnet Cove Barium Corporation.

LOOK FOR THE AQUANESS SEAL

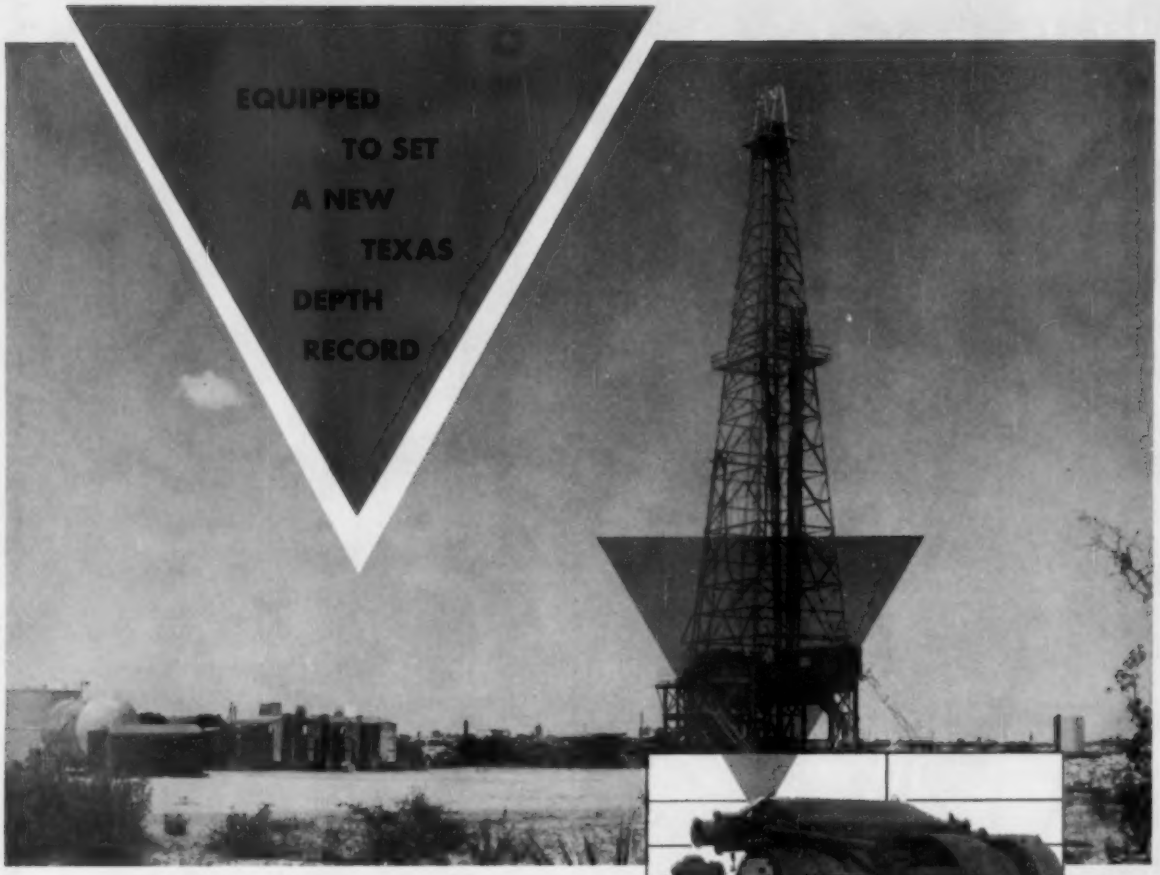
It identifies the ***original*** *low-solids, high-speed drilling fluid emulsifier, made by Aquaness for leading mud companies.*

ATLAS

Aquaness *Department*

ATLAS POWDER COMPANY

2005 Quitman Street, Houston 26, Texas



The rig now drilling toward a new Texas depth record of 22,000 ft. in Pecos County is equipped with a U-1220 electric draw works.

The choice of equipment for this deep test was of primary importance. In selecting the U-1220 draw works, the contractor has assured the operators speed of operation, minimum down time, and dependable performance.

Simplicity of operation and ease of maintenance are design characteristics of the unit. The U-1220-EB Electra-Flow Draw Works is available in a single or split package. Included among other important features are extra large diameter and wide spooling drum, large braking capacity, and centralized lubrication.

You can depend upon a Unit Rig draw works to turn in an outstanding performance—anywhere—because it is "designed for the job."

THE U-1220-EB
ELECTRA-FLOW
DRAW WORKS

UNIT RIG and EQUIPMENT CO.
Box 1889, Tulsa, Okla.
Export Sales: MID-CONTINENT SUPPLY CO.
45 Rockefeller Plaza, New York 20, N. Y.
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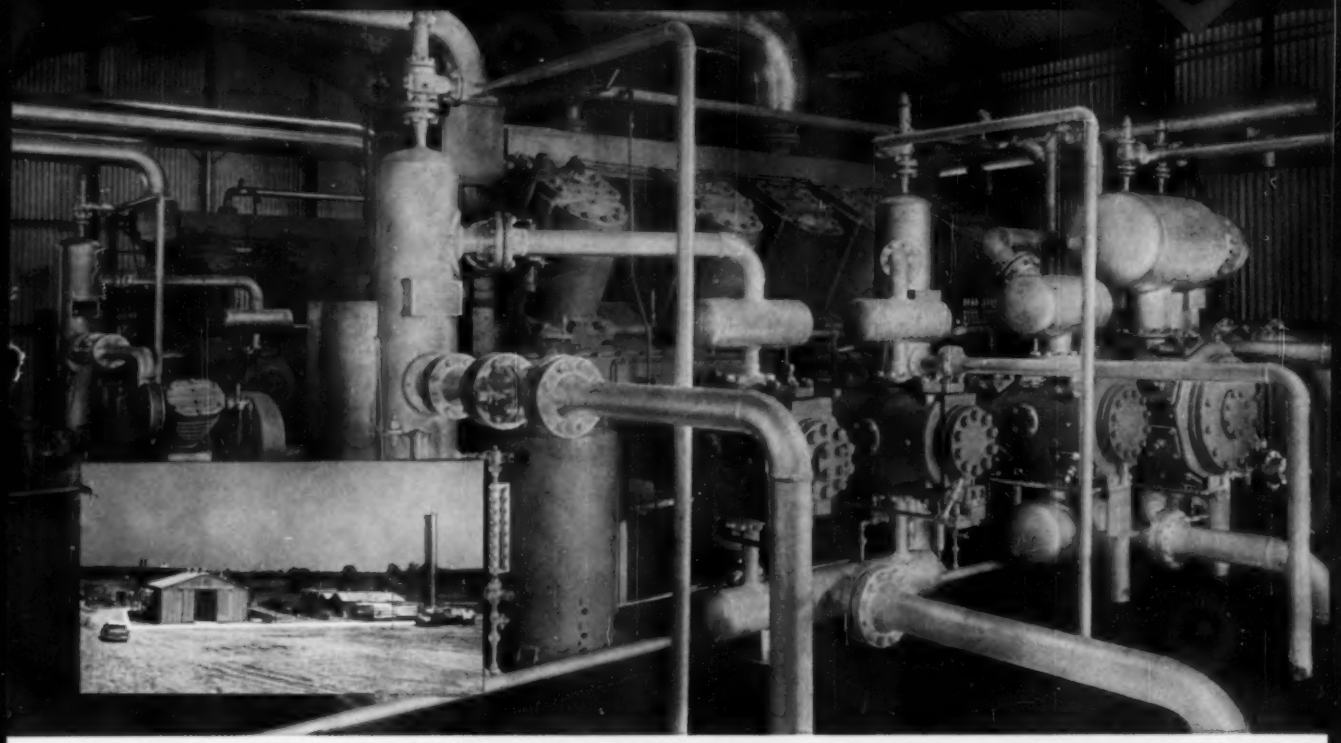
BEAIRD-INGERSOLL-RAND Packaged Compressor Plant



Tatum Gas Plant equipped with two Beaird-Ingersoll-Rand 10SVG 550 h.p. packaged compressors. Units are complete with all necessary controls for unattended operation. Other sizes from 120 to 660 h.p.

Packaged Compressor Equipped . . .

GAS PROCESSING BOOSTS FIELD ALLOWABLES

Robert Cargill, operates this gas processing plant in the Tatum-Petit Field. Located just outside the city limits of Tatum, Texas, the field has grown from a single wildcat to 75 producing wells in less than three years. During this swift expansion it became evident that the increasing number of high gas-oil ratio wells would curtail oil production unless a means was provided to conserve the excess gas. An additional problem was created by the wide variation of wellhead pressures which ranged from 25 psig. to 650 psig.

Engineers called in by Robert Cargill solved the production problem by designing a gas processing plant to remove heavy elements as marketable by-products and to boost the dry gas to a nearby sales line. Two Beaird-Ingersoll-Rand 10SVG 550 horsepower packaged compressors were selected for the main station. Each compressor has been engineered to handle both low and high pressure streams. Low pressure gas is boosted through three compression stages then tied into the discharge of the fourth cylinder which boosts the high pressure stream. The plant can process 20 mmcfd. at 850 to 1,000 psig. discharge with its present arrangement.

As future requirements demand, additional packaged units may be economically installed to handle the increased load. When the field is depleted the compressors may be moved to other service with little or no change in piping or manifolding.

Let us assist you in planning an economical solution to your production problem. Call or write . . .

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana
A Subsidiary of American Machine & Foundry Company

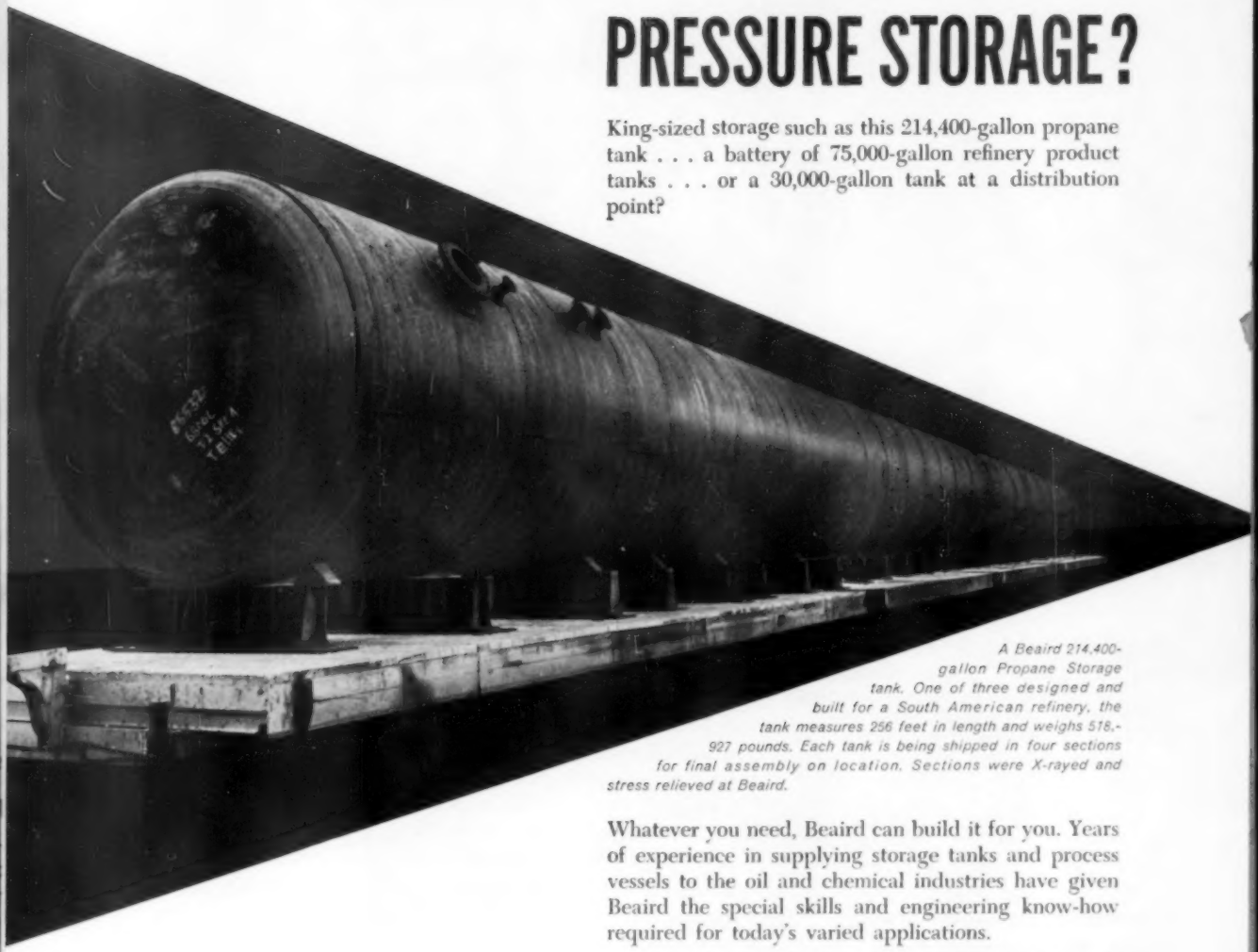
BEAIRD
another AMF product
PACKAGED COMPRESSOR PLANTS

LOWEST COST PER HORSEPOWER INSTALLED

SHREVEPORT, LOUISIANA. *Sales Offices: Dallas, Houston, Corpus Christi and Midland, Texas • New Orleans, Louisiana • Tulsa, Oklahoma • Denver, Colorado • Los Angeles, California • Caracas, Venezuela • Cie. Ingersoll-Rand, Paris, France.*

What do YOU need in PRESSURE STORAGE?

King-sized storage such as this 214,400-gallon propane tank . . . a battery of 75,000-gallon refinery product tanks . . . or a 30,000-gallon tank at a distribution point?



A Beaird 214,400-gallon Propane Storage tank. One of three designed and built for a South American refinery, the tank measures 256 feet in length and weighs 518,927 pounds. Each tank is being shipped in four sections for final assembly on location. Sections were X-rayed and stress relieved at Beaird.

Whatever you need, Beaird can build it for you. Years of experience in supplying storage tanks and process vessels to the oil and chemical industries have given Beaird the special skills and engineering know-how required for today's varied applications.

You benefit as well from Beaird's Quality Control. Modern X-ray equipment, hydrostatic testing, stress relieving facilities, full-time insurance inspectors and strict adherence to fabricating code procedures all play important roles in building Beaird pressure storage.

When your next project is in the idea stage, call in a Beaird sales engineer. His specialized knowledge can help you obtain maximum storage at lowest possible cost.

Over 200,000,000 Gallons Experience

BEAIRD
another AMF product
PRESSURE STORAGE VESSELS

THE J. B. BEAIRD COMPANY, INC.
A Subsidiary of American Machine & Foundry
Shreveport, La. • Stockton, Calif. • Clinton, Iowa

THERE'S SOMETHING NEW ON THE LINE

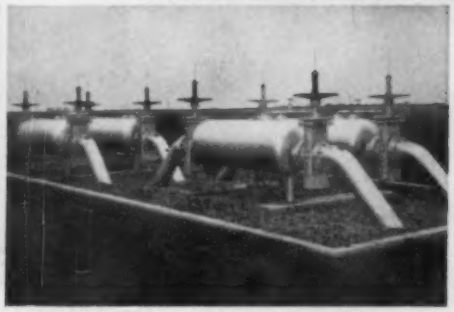
505

wherever products, crude or gas are flowing, you'll continue to see more and more of these

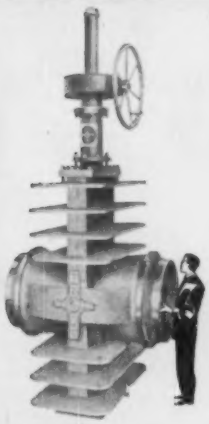
NEW GROVE SEAL-"O"-RING FABRICATED STEEL GATE VALVES

Opening a whole new realm of gas and petroleum pipe line applications, the Grove fabricated steel through-conduit valve body introduces a new concept of design flexibility, safety and dependability. Full opening or Venturi types are available with flanged or welding ends for 2" to 36" lines in ASA Series 150, 300, 400 and 600. For the full story on the valve of tomorrow – already proved in use today – contact your Grove representative, or phone, write or wire for details.

This is one of several carloads of new Grove Seal-"O"-Ring fabricated steel gate valves en route to a major gas pipeline.



Bubble-tight seal, with flow in either direction, plus freedom of operation of Grove Seal-"O"-Ring Valves is important on products line installations of this type.



GROVE SEAL-"O"-RING Gate Valves

SUBSIDIARY OF WALWORTH

GROVE VALVE and REGULATOR COMPANY • 6529 Hollis St., Oakland 8, Calif.
HOUSTON 23—3517 Polk Ave. • • • • • **LOS ANGELES 6**—1930 W. Olympic Blvd.

GROVE SEAL O RING GROVE SIMPLICITY ACCURACY SAFETY

ODESSA, TEXAS • TULSA, OKLAHOMA • CHICAGO, ILLINOIS • DENVER, COLORADO • In Western Canada: GROVE VALVE LIMITED, EDMONTON

IN VENEZUELA

6 YEARS DRILLING WITHOUT OVERHAUL

UNIT RIG DRAWWORKS

Another Unit Rig Drawworks has chalked up an outstanding operational record. In Venezuela, this U-15 drawworks drilled for six years without requiring a single major repair. Put into operation by Loffland Brothers Company of Venezuela in 1951, this rig has drilled 78 wells, a total of 633,729 feet, with an average well depth of 8124 feet. For information on a Unit Rig to fit your drilling requirements anywhere in the world, contact your Mid-Continent representative.

Shown in operation in Venezuela is the Unit Rig U-15 drawworks powered by Cummins LRI-600 engines.

EXCLUSIVE EXPORT DISTRIBUTOR

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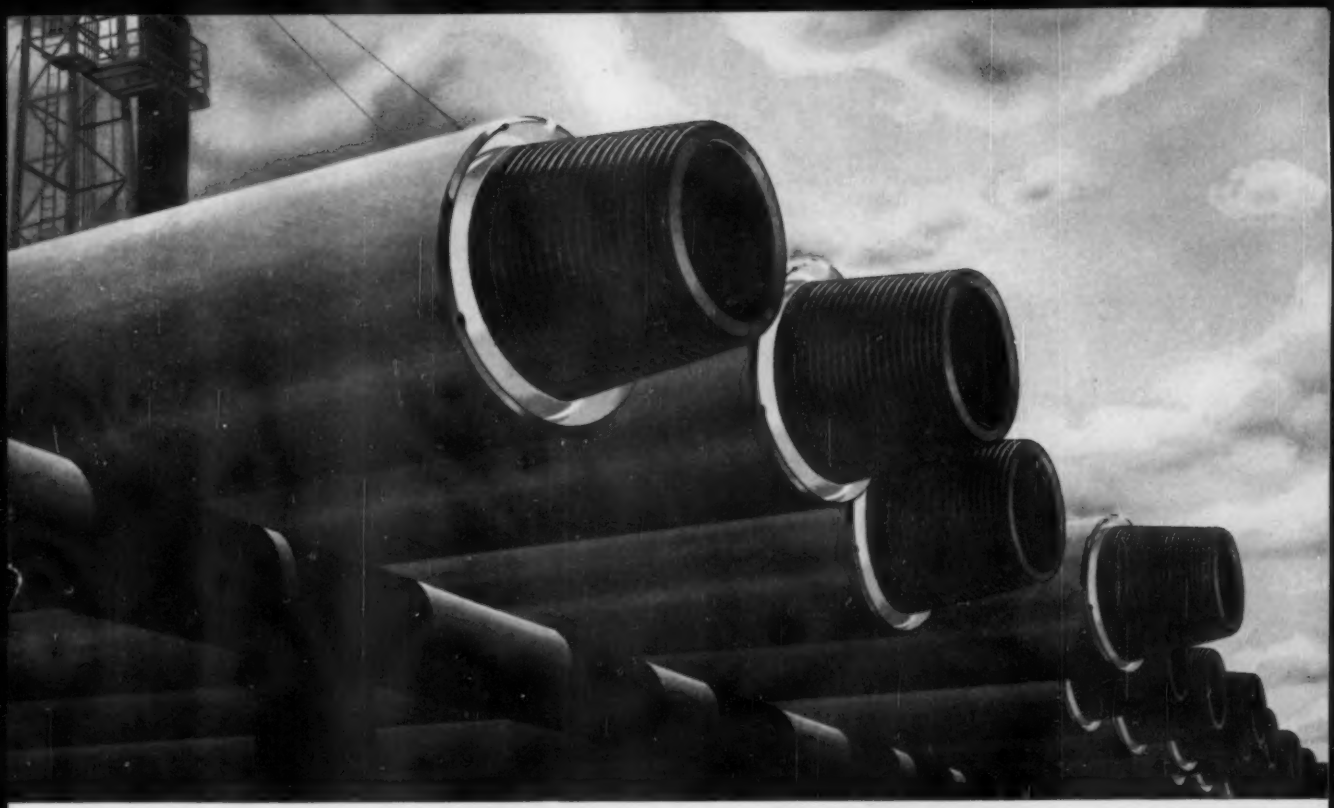
MID-CONTINENT Supply Company

MID-CONTINENT BLDG. FORT WORTH, TEXAS

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY



How American Iron Premium Steel Drill Collars add longer life to your entire drill string!

Through the miracle of the Metallograph, our metallurgists check and accept from the mill only those bars which meet American Iron's high-specifications for *premium* drill collar steel! Overall heat-treating of each bar assures a uniform micro structure throughout the body of the drill collar . . . for highest tensile and impact strengths.

Precision machining of outside drill collar diameter and micro-accurate "coring" produce a *uniform wall thickness* end-to-end, minimizing the possibility of bending or kinking in the hole. This *balance* in American Iron drill collars is a safeguard against unnecessary, destructive drill string vibration!

Check your drill collar performance—and you'll see the difference in more footage drilled with *less drill collar trouble*—when you're using American Iron Premium Steel drill collars!

Specify American Iron Premium Steel drill collars at your Supply Store.

AMERICAN IRON & MACHINE WORKS CO., INC. · MANUFACTURERS OF OIL FIELD EQUIPMENT · A · OKLAHOMA CITY ·

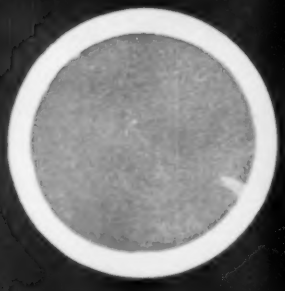
Another AMF Product
PETROLEUM EQUIPMENT

AMERICAN IRON & MACHINE WORKS COMPANY, INC.
518 North Indiana Avenue • Oklahoma City, Oklahoma
Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

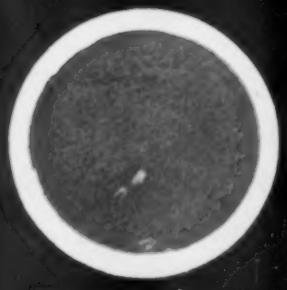
Actual photos of filters through which brine has flowed for 2000 seconds show how citric acid prevents iron precipitation which clogs pores, cuts down flow rate

Brine Contained Iron and Citric Acid

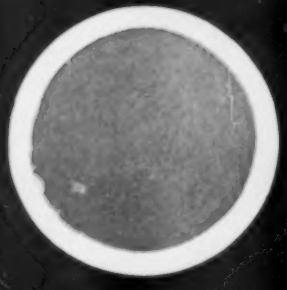
Brine Contained No Iron



Brine Contained Iron and Polyphosphate



Brine Contained Iron and EDTA



Brine Contained Iron Alone

Dramatic Test

how effectively you can improve

IN extensive laboratory tests, the Technical Service Department of Chas. Pfizer & Co., Inc., measured the rates at which brines with and without sequesterants flowed through filter discs. In each case the water used was an East Texas oil field brine.

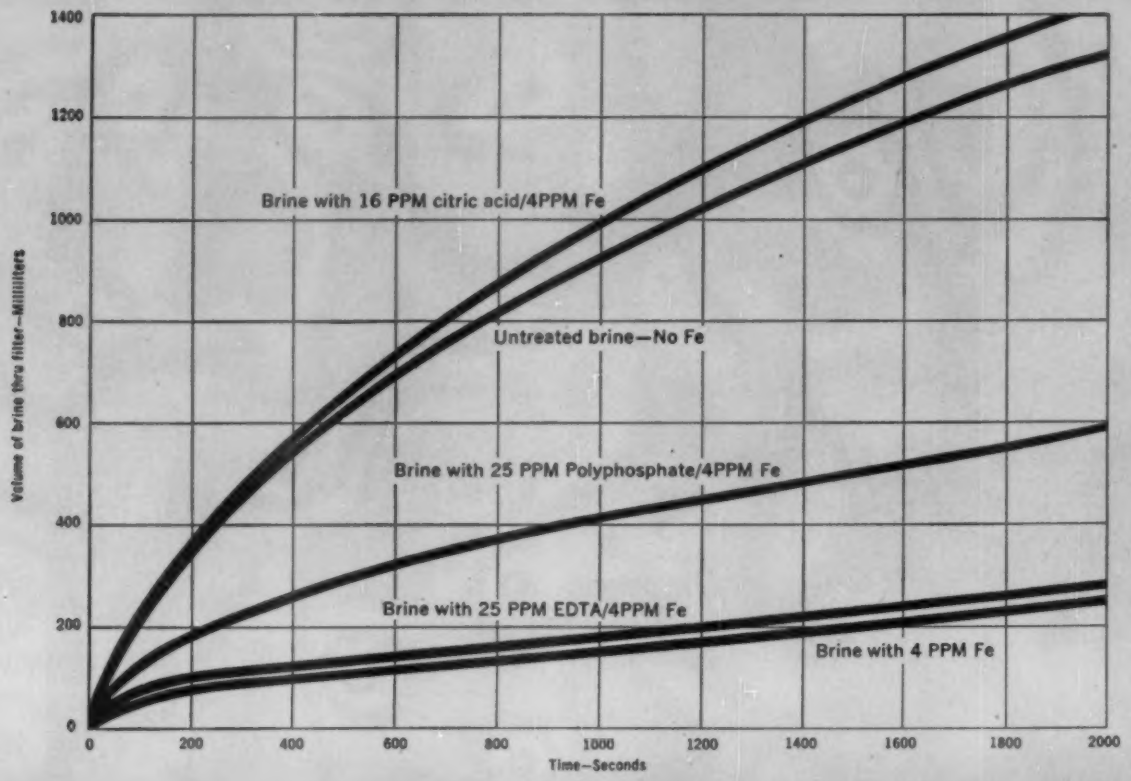
The five circles you see on the left are actual photographs of some of the membrane filter discs used. Each disc is 150 microns thick and has *50 million* pores per square centimeter! These minute pores closely simulate the sandface through which your injection water must flow.

In the lab tests, the brine was first pre-filtered to remove solid particles, then poured into five containers. Four parts per million of soluble iron was added to each container except *one*. Sequesterants were added to three of the brine solutions.

After aeration, rate of flow through the membrane filter discs was measured. The results, as you can see from the graph and the color of the discs, proved conclusive. *Citric Acid was far superior in preventing iron precipitation, and kept flow rates highest.*

Results Demonstrate

flow rates by adding citric acid to your injection water



If you want to stop iron from plugging sandface pores, add citric acid to *your* injection water. *Pound for pound, citric acid not only sequesters iron better but also at less cost than any other agent.* It's nontoxic, safe to handle, and works even in high calcium waters.

Pfizer supplies huge amounts of citric acid for a multitude of industrial uses throughout the world. This large volume production assures you of receiving all the citric you need without delay. For further information on preventing injection well plugging with Pfizer Citric Acid write to:

CHAS. PFIZER & CO., INC.
Chemical Sales Division
630 Flushing Ave., Brooklyn 6, N.Y.

Branch Offices:
Chicago, Ill.; San Francisco, Calif.; Vernon, Calif.; Atlanta, Ga.; Dallas, Tex.

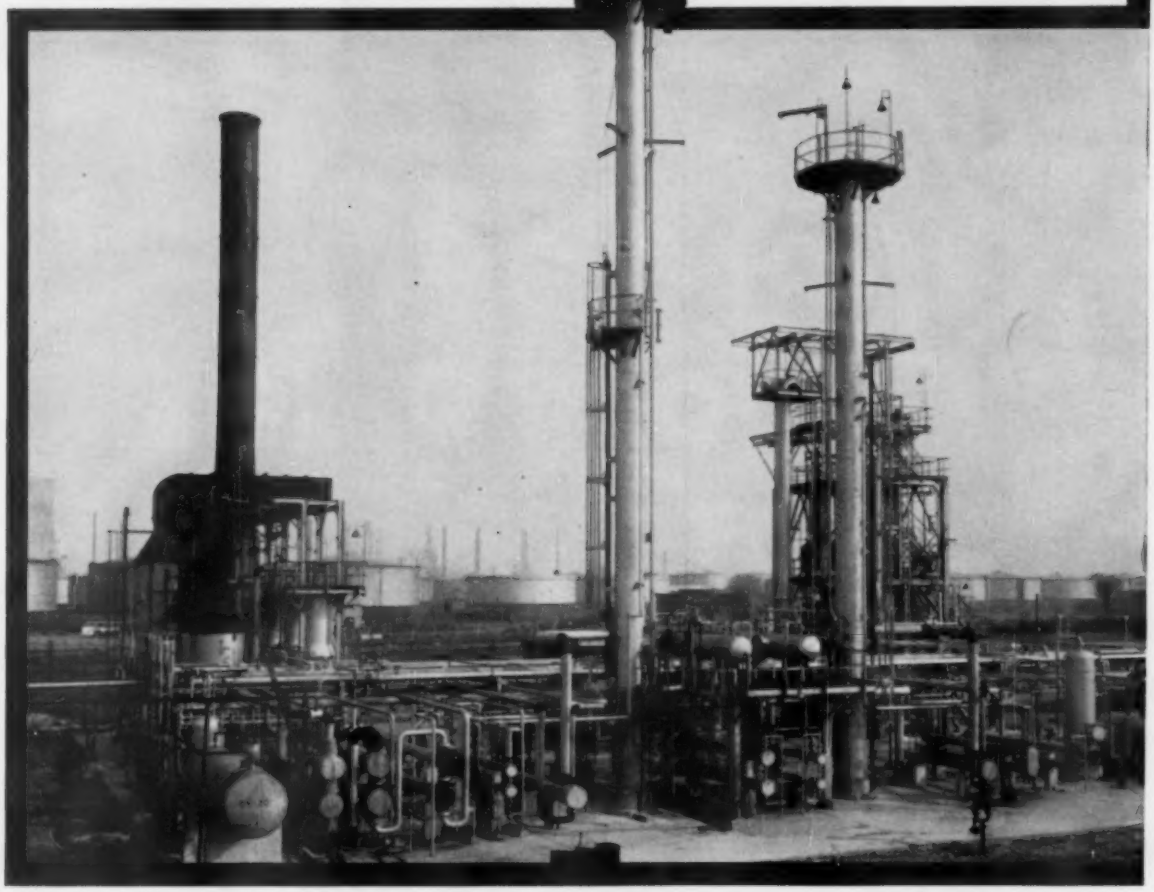
Manufacturing Chemists

Pfizer

for Over 100 Years

In Britain . . .

ANOTHER JOB WELL DONE by PROCON



At home or abroad, wherever you need to build, Procon offers the finest construction service. This 800 B/SD Platforming® unit was built by Procon (Great Britain) Limited. The unit was designed to produce an 85 to 90 RON clear product from Kuwait naphtha or a 90 to 95 RON clear blending component from mixed Peruvian naphthas. The Platformer construction included a prefractionator to separate naphtha from full-range gasoline or to prepare a 53-150°C. naphtha for Platforming feed from Peruvian stock.

In England, as in all other parts of the free world, Procon is serving the petroleum, petrochemical and chemical industries with better plant design and construction.

If you want a job done, and done right, anywhere in the world . . .

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PROCON *Incorporated*

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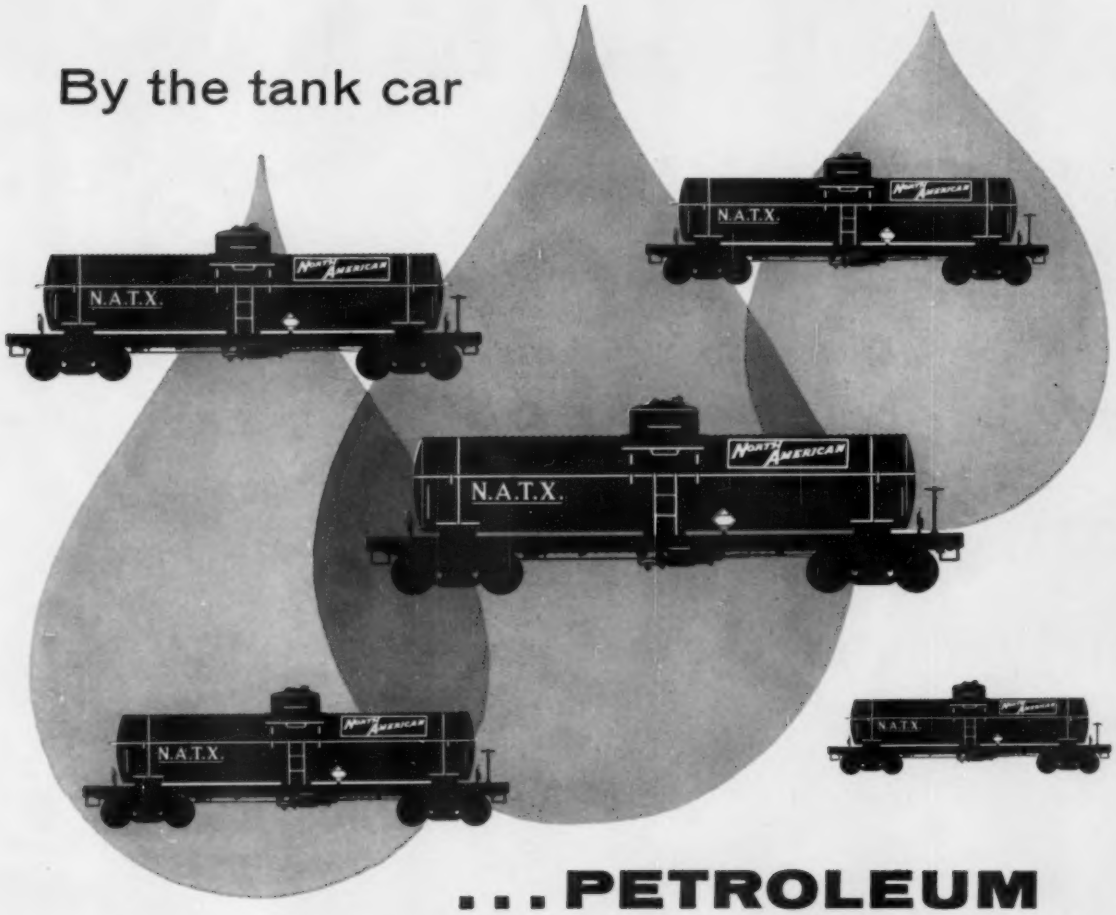
WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

By the tank car



...PETROLEUM FOR YOUR CUSTOMERS

and plenty of goodwill for you!

Your North American tank cars are where you want 'em, when you want 'em . . . kept on the move by nine big repair and conditioning shops for dependable service. When you lease our equipment, you're assured of a continuous car supply for better planning, improved shipping, more satisfied customers. Your transportation needs are our business. If we haven't the cars you need, we'll be glad to build you special ones . . . and then lease them to you.

NORTH AMERICAN CAR CORPORATION

NORTH WESTERN REFRIGERATOR LINE COMPANY

MATHERS HUMANE STOCK TRANSPORTATION COMPANY

231 South LaSalle Street, Chicago 4, Illinois

A NATIONWIDE ORGANIZATION WITH BRANCH OFFICES IN IMPORTANT MARKET CENTERS

DALLAS • FOND DU LAC • ST. PAUL • ST. LOUIS • TULSA • SAN FRANCISCO • NEW YORK

A pipeline pumping station—powered by a gas turbine and equipped with a heat exchanger—has a decided economic edge over other stations. Manpower, for example, is as little as 20% of that needed by stations powered by diesel, steam or gas engines.

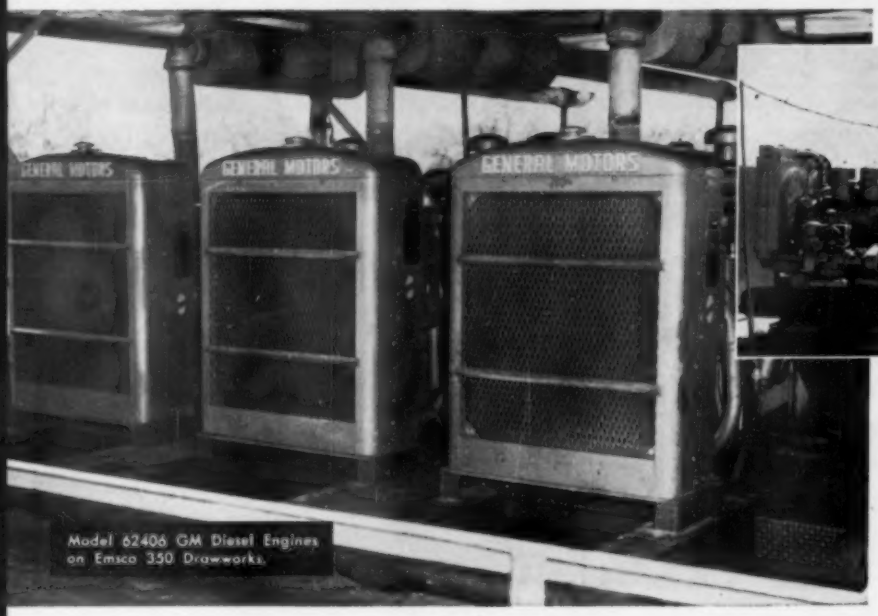
What part does the heat exchanger play? If it's an APCO extended sur-

face regenerator, it can recover up to 80% of the available heat in the gas turbine exhaust . . . and thereby cut fuel by 30%.* What's more, it takes less than 500 manhours to erect a unit on a 5000 hp cycle. Maintenance needed thereafter: zero. For details, contact:

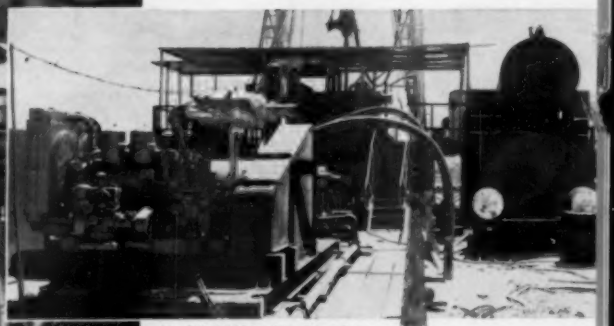
Air Preheater Corp.,
60 E. 42nd St.,
New York, N. Y.

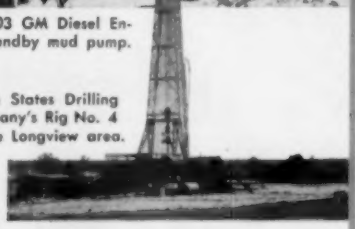
* At 1500 F, a 6-1 pressure ratio, and a designed effectiveness of 75%.

DEPENDABLE POWER



Model 62406 GM Diesel Engines on Emsco 350 Drawworks.


Model 12103 GM Diesel Engine on Standby mud pump.


South States Drilling Company's Rig No. 4 in the Longview area.

STORY OF A "REVITALIZED" RIG

When South States Drilling Company, Longview, Texas, decided to repower their Rig No. 4, they chose Stewart & Stevenson GM Diesel Power through Industrial Power & Supply. Gas/butane powered engines formerly were used.

The results?

"We noticed a decided improvement in power and acceleration," Mr. B. J. Baird testifies, "particularly in coming off bottom with a heavy string of drill pipe. We were able to reduce our trip time considerably."

Rig No. 4 has an Emsco GA 350 Drawworks with a 7¼-inch by 14-inch Gardner-Denver mud pump. This was repowered with three 6-110 GM Diesel Engines. Also, Rig No. 4 has a B-14 Emsco mud pump for stand-by service powered by a Model 12103 GM Diesel Engine.

This drilling contractor found the pump on the compound could be used to its rated capacity after the repowering job. This is without loss of drilling power on the rotary table.

Economy: "A 40% savings over our past operation," Mr. Baird says.

Overall performance: "Well pleased."

Service: "Excellent."

Stewart & Stevenson Services, Inc., the world's largest distributor of diesel engines, has the answer to your drilling power needs, regardless of the size or type of your rig.

A combination of the right power and utmost efficiency in service means more efficient operations for you. And that's money in the bank.

STEWART & STEVENSON

STEWART & STEVENSON SERVICES, Inc.

Main Office and Plant:	4516 Harrisburg Blvd., Houston 11, Texas Phone CApitol 5-5341
Branches:	Corpus Christi, Dallas, Lubbock, San Juan, Odessa
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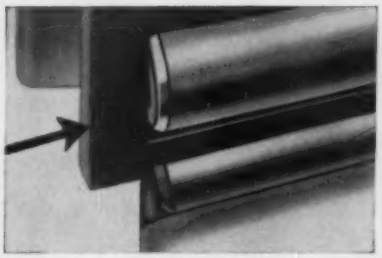
Export Office:	Room 1405, 74 Trinity Place, New York, N. Y.

We're proud of our record in meeting every power need for the nation's leading drilling contractors

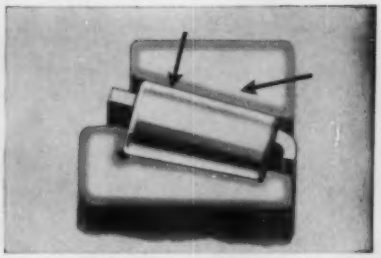
THE WORLD'S LARGEST DISTRIBUTOR OF DIESEL ENGINES

Get all these advantages . . . specify TIMKEN® tapered roller bearings

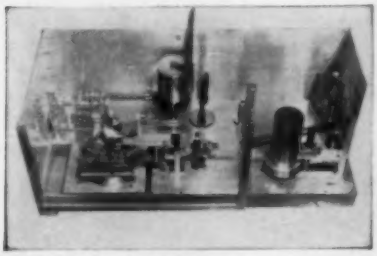
THERE ARE 27 TYPES of Timken® tapered roller bearings. This wide selection means you get the bearing design exactly suited to your job. Whatever your bearing application problem, we can help solve it.



THE SOFT STEEL CAGE used in Timken tapered roller bearings separates the rollers, keeping them spaced evenly. This prevents scuffing of the rollers, adds to the bearing life and gives you more for your money.

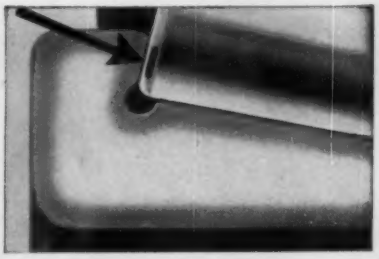


HARD ON THE OUTSIDE, tough on the inside. To take shock loads, give longer life, Timken bearing rollers and races are case-carburized to have a hard, wear-resistant surface over a tough, shock-resistant core.



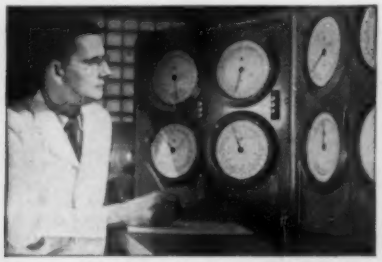
MICRO-INCH FINISH is standard for Timken bearings. This profilograph checks contours and smoothness of circular surfaces to a millionth of an inch, helps us make Timken bearings truer, quieter, longer-wearing.

6,525 SIZES, the world's largest selection of tapered roller bearings. From bearings smaller than your finger to 71½" in inside diameter, the Timken Company can supply the size you need for any specific application.

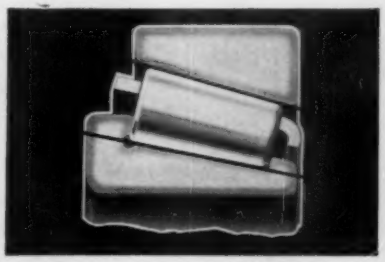


POSITIVE ROLLER ALIGNMENT is assured because the taper in Timken bearings holds ends of rollers snug against the rib. The taper in Timken bearings lets them take radial or thrust loads or any combination.

ACCURATE TO 50 MILLIONTHS of an inch. This Universal Measuring Machine checks gages and machine parts used to make Timken bearings. Our gage laboratory, one of the world's best equipped, helps make Timken tapered roller bearings your No. 1 bearing value.



WE MAKE OUR OWN FINE ALLOY STEEL. No other American bearing maker does. This spectrometer helps control steel quality—in 40 seconds gives the exact chemical analysis of a melt. In a few minutes, results are flashed to the melter. It's another step in rigid quality control.

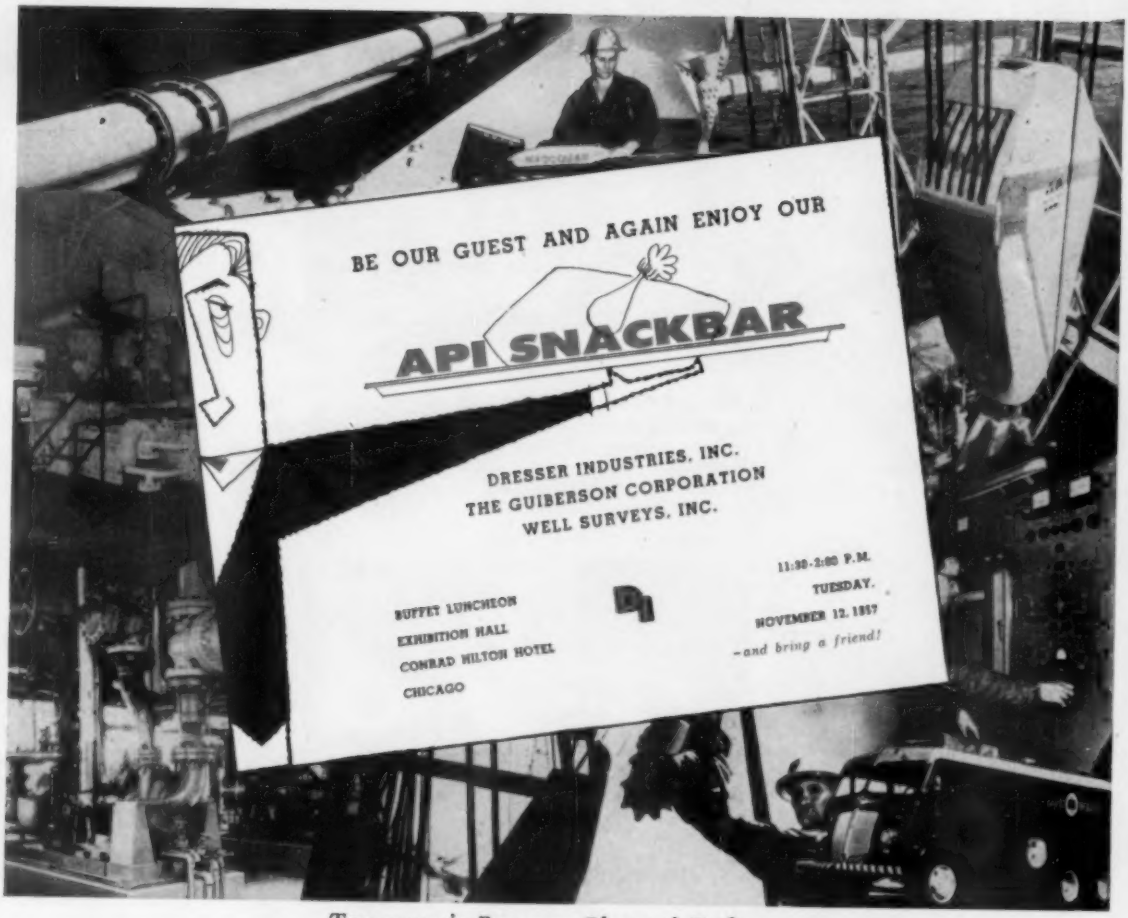


FULL LINE OF CONTACT between Timken bearings' rollers and races gives them *extra* load-carrying capacity. To get *all* these advantages, specify "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN *TAPERED ROLLER BEARINGS ROLL THE LOAD*

TRADE-MARK REG. U. S. PAT. OFF.

See the next Timken Televent hour, "The Innocent Years" over NBC-TV, Thursday night, November 21st.



Tomorrow's Progress Planned Today

AMERICAN PETROLEUM INSTITUTE

37TH
ANNUAL MEETING

Conrad Hilton Hotel
Palmer House
Chicago, Illinois
November 11-14, 1957

Dresser pays tribute to the members of the American Petroleum Institute for their many contributions to the progress of our vital oil and gas industries.

THE DRESSER INDUSTRIAL TEAM SERVES THE GROWING OIL

the Dresser Badges of Merit plus+

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CLARK BROS. CO., Olean, New York —Gas turbines, engines, and reciprocating, centrifugal and axial flow compressors—gas, steam, electric and diesel driven.

DRESSER IDECO

DRESSER-IDECO COMPANY, Columbus, Ohio—Radio and television broadcasting towers, steel buildings, aircraft hangars, electric power substations.

DRESSER
MANUFACTURING DIVISION

DRESSER MANUFACTURING DIVISION, Bradford, Pa.—Pipe line couplings, pipe repair sleeves and clamps, weldments, forgings, welding fittings, flanges, rings.

GUIBERSON
SEE THAN SORRY — BETTER BE S.

THE GUIBERSON CORPORATION, Dallas, Tex.—Swabs, packers, anchors, workover equipment—drilling heads, blowout preventers, tubing blocks, hooks, swivels, kellys, savers, unions; Gas lift equipment. Molded rubber products.

IDECO

IDECO, Dallas, Tex.—Hydrair* and Power Rigs; Full-View* Masts; substructures; single, dual and Drive-In Rambler Rigs; blocks, swivels, rotaries, mud pumps, petroleum equipment and supplies.

LANE WELLS

LANE-WELLS CO., Los Angeles, Calif., Houston, Tex., Oklahoma City, Okla.—Electric and Radioactivity Well Logging, Koneshot* perforating and bullet perforating, packers and bridging plugs.

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MAGNET COVE BARIUM CORP., Houston, Tex.—Magcobar* and Magcogel* drilling muds and other specialized oil well drilling fluids and chemicals.

PACIFIC

PACIFIC PUMPS, INC., Huntington Park, Calif.—Centrifugal pumps for refineries, power stations, pipelines, and chemical plants; plunger pumps for oilwells.

ROOTS RC CONNERSVILLE — SINCE 1854

ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind.—Rotary positive blowers, gas pumps, centrifugal blowers, exhausters, vacuum pumps, and positive displacement meters.

Security

SECURITY ENGINEERING DIVISION, Dallas, Tex., Whittier, Calif.—Rock bits, reamer rock bits and hole openers; reamers, casing scrapers and Neo-Red rubber stabilizers.

SIE

SOUTHWESTERN INDUSTRIAL ELECTRONICS CO., Houston, Tex.—Seismograph systems and instruments—electronic, electro-mechanical. Coniputers—analog and digital; recording systems. Special transformers, reactors.

WELL SURVEYS

WELL SURVEYS, INC., Tulsa, Okla.—Nuclear and electronic research and development for the petroleum and other industries. Originators of radioactivity logging.

*Trademark registered

put this DRESSER *plus+* team to work for you!

You receive a bonus of extra value whenever you are served by any one of the Dresser companies. *Men with imagination* provide the research, engineering, manufacturing and service applications for the particular specialties of each Dresser operating unit. All Dresser companies work together with their combined experience and facilities to form the world-wide Dresser industrial team. This inter-company teamwork offers a bonus in greater experience and technical knowledge—backed by the extensive Dresser facilities—in the customer's specific industry. This intangible but important factor is known the world over as the Dresser plus+ . . . the mark of superior equipment and services for the oil, gas, chemical, electronic, and general industry.

Dresser's world-wide engineering experience in many industries plays a major role in the creation of new developments and improved technological methods. No other single company provides the same broad range of equipment and services. The Dresser plus+ is a symbol for the superior quality of equipment and technical services which have become the standard of comparison in industries the world over!

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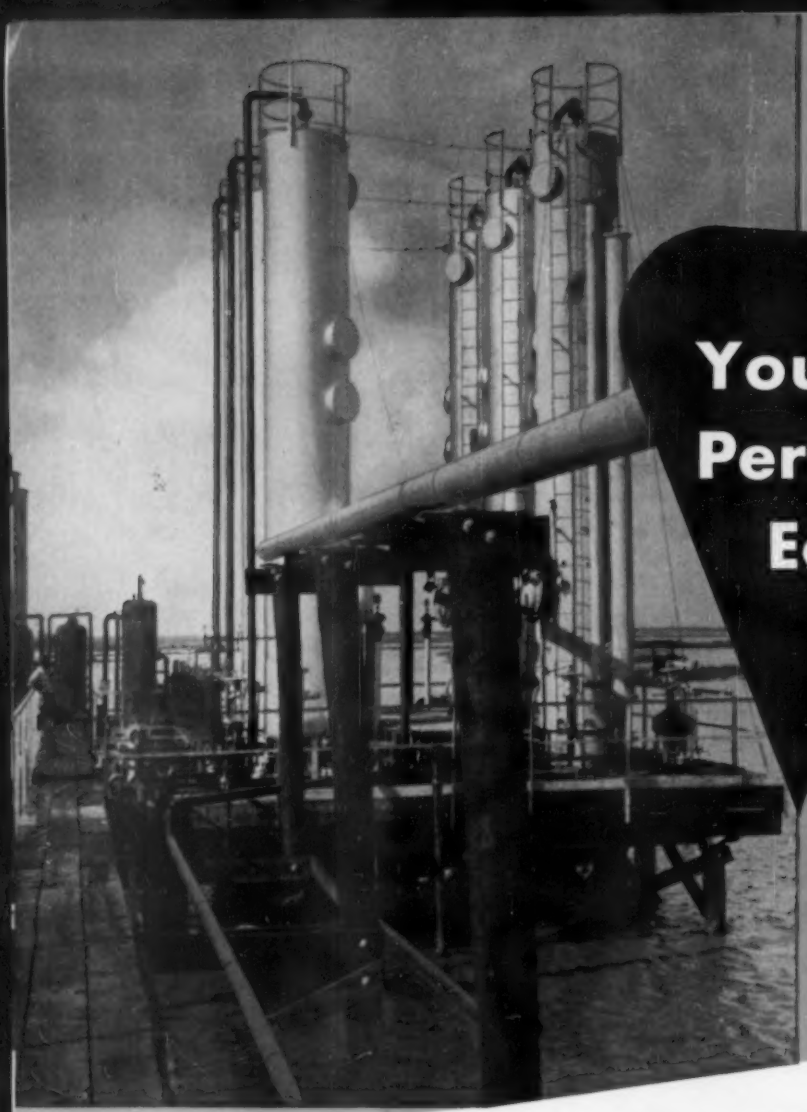
GAS, CHEMICAL AND ELECTRONIC INDUSTRIES — EVERYWHERE



You'll Get Top Performance And Economy...

From BS&B Model "J" Treaters Wherever You Put 'Em!

You may have to look twice to "spot" 'em all, but there are six BS&B Model "J" Treaters in the installation pictured above. Together, they are giving top level performance in treating approximately 2400 bbls. of oil daily on a major oil company lease near the mouth of the Mississippi river.

Normally such treaters would be individually heated by means of their own internal fireboxes, and would of necessity be spaced farther apart.

However, because of the limited space available for platform mounting... and because they are in close proximity to a battery of storage tanks mounted on the same platform... these treaters are heated by steam from a remotely located BS&B Steam Generator. Thus, a considerable saving is made on pipe connection work as well as on expensive platform space.

This is an example of the versatility and adaptability of the Model "J" Treater in meeting virtually any operating conditions... and of its ability to deliver maximum return per dollar invested!

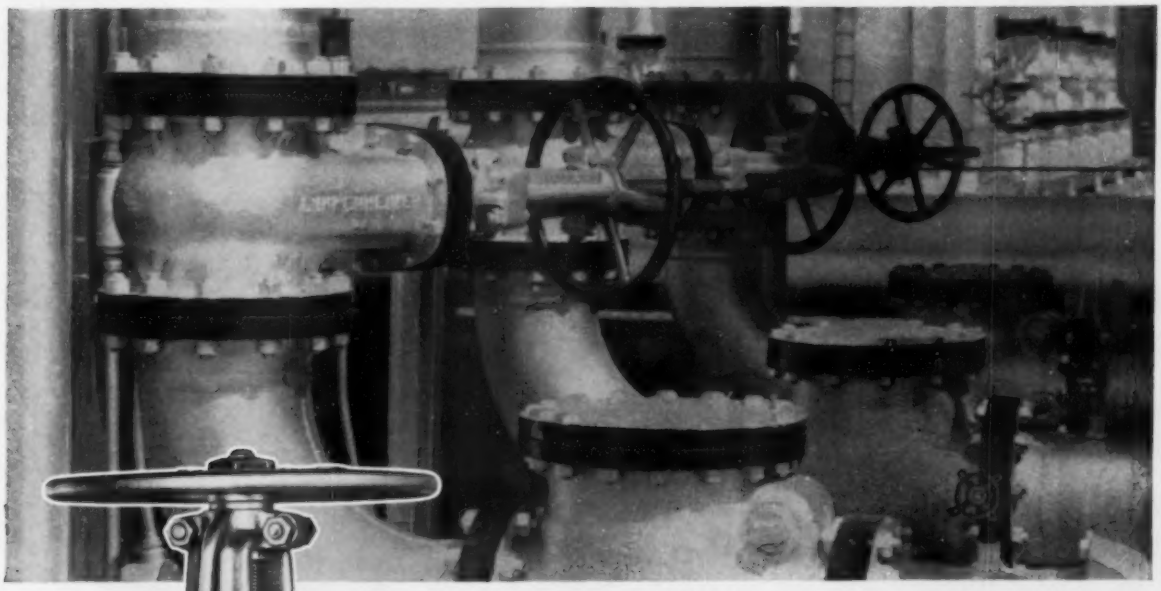
Why not call your BS&B Man to give you complete data on the Model "J", or on one of the other Treaters in the BS&B line? Or, you may write to...

BLACK, SIVALLS & BRYSON, INC.

Oilfield Equipment Division, Dept. 1-A11
P.O. Box 1714 Oklahoma City, Okla.

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

Service Records Show
Lunkenheimer Steel Valves Cost Less



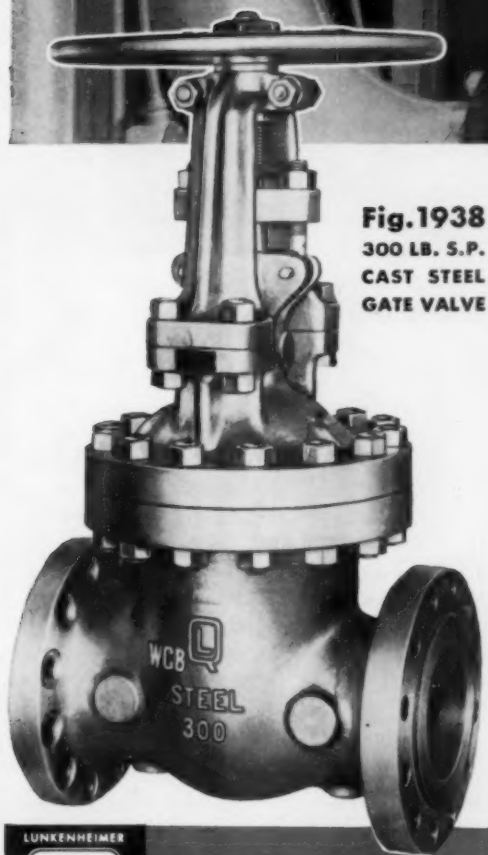


Fig. 1938
300 LB. S.P.
CAST STEEL
GATE VALVE

With maintenance costs up higher than ever before, the price you pay for the average valve is only a fraction of its total cost. Every time a valve needs repair, its cost rises higher and higher . . . actually dwarfing its original cost. That's why so many leading petroleum companies depend on Lunkenheimer Cast Steel Valves. Service records show that Lunkenheimer Valves cost less than any other steel valve on the market.

Lunkenheimer Steel Valves are manufactured in the industry's newest, most modern valve plant . . . with the latest precision machinery. Their outstanding design features, materials, and workmanship backed by years of experience and leadership in metallurgy, pay for themselves many times over in the maintenance dollars they save. Always insist on Lunkenheimer Valves . . . famous for quality and maintenance-free service since 1862.

The Lunkenheimer Company, Cincinnati 14, Ohio.

BRONZE • IRON • STEEL • PVC

L-1957-5

LUNKENHEIMER QUALITY

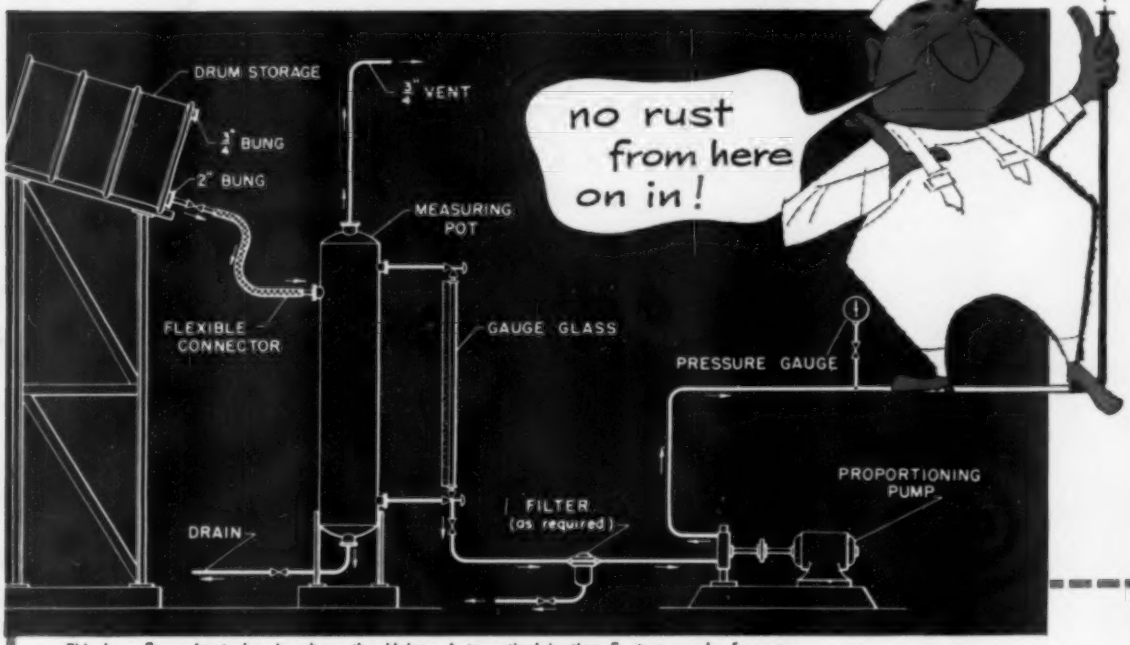
LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

If it's a question of corrosion...

UNICOR®

...is the answer



This is a flow chart showing how the Unicor Automatic Injection System works for you.

Question: *How can we eliminate serious filter fouling in blending tank caused by formation of highly peptized iron rust during processing?*

Answer: UOP's Unicor corrosion inhibitor solved this problem for a large southern refiner not long ago. Before Unicor application, a yard-square panel of the tank interior was sandblasted down to bare metal to test Unicor's effectiveness. After several months of injection in the rundown line, this test panel was completely free of corrosion, the remainder of tank interior was free of filter-fouling rust.

Question: *Is addition of water necessary?*

Answer: No. Unicor is oil soluble. It also prevents rusting caused by unavoidably entrained or dissolved moisture.

Question: *Should Unicor be injected only in the rundown line?*

Answer: Unicor can be injected at any point in your process. The refiner mentioned above shifted the Unicor injection point from the rundown line to his crude fractionator overhead and in catalytic gasoline from the main column overhead receiver. This extended Unicor's protection to heat exchangers, condensers and towers between new injection points and blending tank. Unicor inhibits corrosion in all your processing equipment from the point of injection on . . . even to consumer equipment.

Question: *How much does Unicor cost?*

Answer: About $0.001 or a tenth of a cent per bbl. of product in normal application.

Let us send you samples of

UNICOR

for testing in your own laboratories.

UOP®

UNIVERSAL OIL PRODUCTS COMPANY

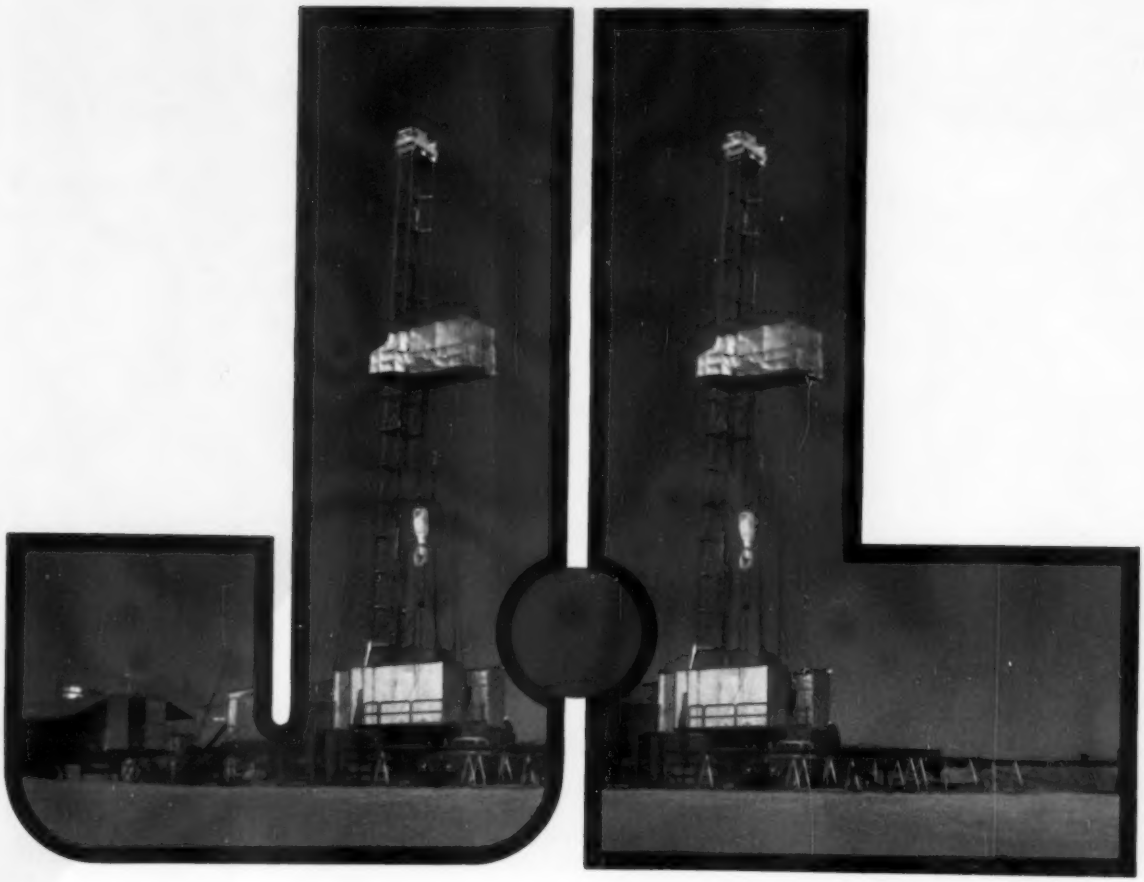
30 ALGONQUIN ROAD
DES PLAINES, ILLINOIS, U.S.A.

Drilling

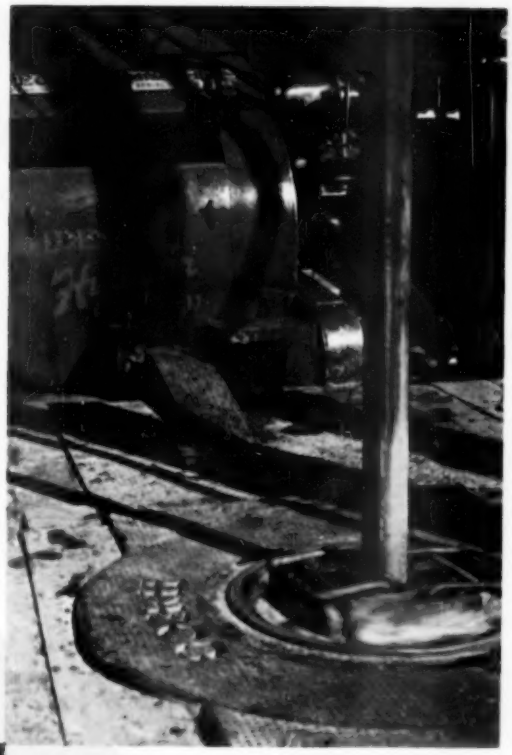
WITH J&L SUPPLY

A customer adds hundreds of competent men to his service and advisory staff and not one cent to his payroll with drilling equipment from J&L Supply. When he moves in with such equipment—anywhere in the United States or Canada—J&L Supply men are waiting like old friends and neighbors with parts, service, encouragement.

On this page a Nebraska scene featuring J&L Supply equipment tailor-made to a major oil company's requirements by Ideco. Diesel electric dual Rambler rig with 105′ Kwik-Lift mast and "E-525" drawworks.

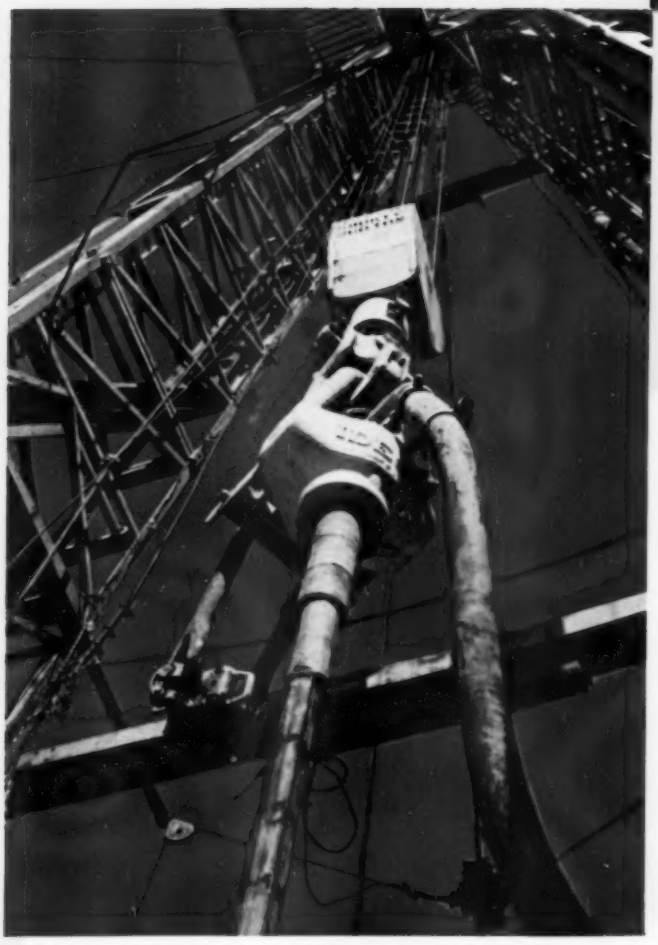


Ideco Mechanical, Electrical, or Hydrair rigs and streamlined rotaries give a driller the feeling that everything's coming his way. And everything is; he has complete control and knows it. Ideco—the most wanted drilling equipment in the world! One third of all rotary tables are Ideco! Table openings from 12″ to 27½″; capacities from shallow workover to deepest drilling. Rig capacities (4½″ drill pipe) to 25,000′. Rigs to 6,000′ capacity can be trailer mounted.



Jones & Laughlin's standard rotary drilling lines with IWRC are made to the industry's most exacting standards to give the driller the utmost in strength and life. In addition, J&L offers SpringKore rotary drilling lines that bring a new concept to rotary drilling with great crush resistance, more internal lubricant, and the greatest flexibility, all of this at the lowest steel center cost. For cable tool drilling, J&L's PlastiKore has a center impervious to acids, salt water, and caustics that so frequently cause early failure in standard fiber center lines.

Nothing adds more to the confidence of a driller than J&L Blue Ribbon Drill Pipe. This is the drill pipe that digs the world's deepest wells with the greatest safety. This is drill pipe inherently right. J&L Supply service goes with it everywhere, alert, informed, helpful. Internal or external upset. Blue Ribbon Heat-treated Alloy Steel, or Blue Ribbon plus Vanadium. Upset for grip type, counterbore weld and flashweld tooljoint application.



Fast (low center of gravity) Ideco Shorty Blocks add as much as 9′ of headroom when unitized with the spring-loaded hook—and they are made to add ton-miles to wire line endurance. To this end the "Fabriform" sheaves are balanced on Double Tapered Timkens for positive alignment regardless of fleet angle or line load, and the roll-forged flame-hardened rims are smooth — even the grain structure is uniform. Automatic safety lock, ingenious hook, and a patented hydraulic cushion provides jarless starts and stops. The Ideco Shorty teams up with the Ideco crown block to give capacities to 560 tons, for truly dependable performance.

Republic Rotary Hose and Ideco Streamlined Swivels give drilling mud a trouble-free right-of-way. The Ideco floating washpipe can be repacked by one man in about 22 minutes with a sealed packing assembly stocked by J&L Supply. The swivel is then normally ready for many more wells before washpipe or packing needs further attention. As for the Republic hose—the higher the pressure the tighter the seal, thanks to the patented connection.

Left, Franks Cruiser. Single or double drum hoist and single or double pole mast with pulling capacities of 2,500′ to 12,000′ depending on the model. Choice of gas, gasoline, LPG, or diesel engine. Hard brake flanges; full-air clutches; one-point brake adjustment; simple, convenient controls. Torque converter drives, and hydraulic equipment for power tongs and other time- and labor-saving devices if desired. Unit anchors quickly and easily under conventional derrick. Can be driven away from pole mast for remote swabbing. The Franks Cruiser justifies its great popularity with J&L customers.

Right, Franks Clipper. Three sizes, with pulling capacities to 14,000′. Low center of gravity. Even weight distribution. Fully protected cab. Heads into location — important when the approach is difficult. Widespread outriggers, balanced for one-man positioning. Telescoping derrick hydraulically operated; automatic lock and stacking board. Remote console gives operator unobstructed view and positive control of the fast, flexible unit. Optional features include hydraulic drive for power tongs and other equipment. Most advanced unit on the market for servicing and workover.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

J&L – A GREAT NAME IN SUPPLIES

BOUGHT 40 MORE

Since he first switched to "Jimmy" Diesels

Back in 1947, Calvert Drilling, Incorporated, started operations with three gas-powered rigs. They promptly switched one rig to General Motors Detroit Diesel power, found this quick-acting, 2-cycle Diesel gave them faster round trips, easier moves and more dependable parts and service availability wherever they went. Now the company has standardized on "Jimmy" Diesels in all their 13 rigs as well as trucks and lighting plants.

Does it pay to standardize on GM Detroit Diesel power? It sure does. For it simplifies your servicing and parts requirements. And you get easier, faster moves *plus* faster, lower-cost drilling, too.

Single and multiple engine units are available in a wide horsepower range for almost any petroleum application. Write us or ask your nearest GM Detroit Diesel distributor for new 16-page illustrated catalog "GM Detroit Diesel Petroleum Engines." It will help you choose the right power for *every* oil field job.

GM GENERAL MOTORS DIESEL POWER

DETROIT DIESEL

Engine Division of General Motors, Detroit 28, Michigan
REGIONAL OFFICES: New York, Atlanta, Detroit
Chicago, Dallas, San Francisco

Now—more than ever—it pays to standardize on GM Diesel
—available in 1485 applications of power equipment
built by more than 175 manufacturers.

Calvert Drilling, Inc., Olney, Ill. GM "6-110" Diesel drives Ideco Hydrair draw works. "Twin 6-71" powers Gardner-Denver mud pump.

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COLORADO—Denver
THE COLORADO BUILDERS' SUPPLY CO.

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General Motors Corporation
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DIESEL EQUIPMENT CO., INC.

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PENINSULAR DIESEL, INC.

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GENERAL MOTORS DIESEL LIMITED
London, Ontario

It's a real slick little tool that can save you a lot of fixed capital investment - and bother - each year.

To obtain well pressure reading, insert master gauge with Connector in Gauge Valve and turn gauge 45 degrees. Gauge Valve opens automatically, exposing gauge to pressure. Remove gauge and Gauge Valve closes automatically.

HERE'S HOW IT WORKS: Instead of buying one or two pressure gauges for each Christmas tree, you buy just one master gauge *for an entire field.* Then, install these inexpensive Gauge Valves where you have been installing permanent type gauges—one on the tubing and one on the casing. Your Gauger takes the master gauge from well to well, stabs it into the Gauge Valve to obtain the pressure reading.

Only one gauge to buy.
No breakage.
No gauge repairs.
No exposure to elements.
No inaccurate pressure readings.

Ask any UNIBOLT man to demonstrate the Gauge Valve and Connector, or write:

THORNHILL UNIBOLT CRAVER CO.

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From Calgary to Kuwait, wherever oil men seek unlimited flexibility in handling fluids, semi-solids and gases, you will find Chiksan Swivel Joints in service. And wherever temporary piping calls for quick, make-and-break wing nut unions, chances are they're Weco Unions.

The reason for this is *proven performance*. Performance that has measured up under the most rugged conditions. Also, Chiksan and Weco's world-wide distribution assures prompt delivery when and where you want it.

Small wonder then that wherever men seek, drill, produce, transfer or process oil, you find dependable Chiksan and Weco products in service.

SERVING

the oil men of the world

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CHIKSAN SWIVEL JOINTS

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SOLD AT LEADING SUPPLY STORES EVERYWHERE

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

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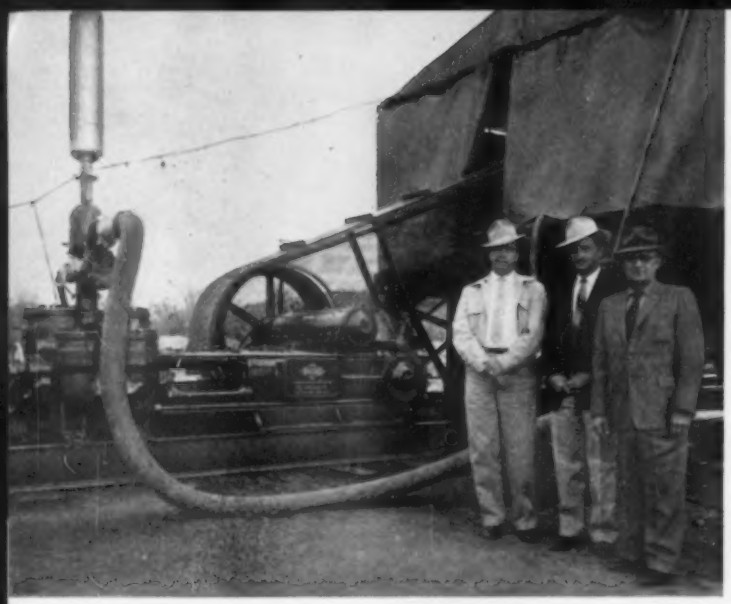
Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Company • Chiksan of Canada Ltd.



"This pump's performance was so satisfactory . . . bought a new (Wheland) HP-8000 pump for the smaller rig."

—J. W. Hastings

Here's the dependable Wheland HP-14000, still doing a fine job after 5 years in the field. Standing left to right, are Mr. J. W. Hastings, Owner; Mr. C. T. Coffman, Drilling Supt.; Mr. Joe Don Carlos, Wheland Representative.

J. W. HASTINGS
DRILLING CONTRACTOR
720-722 WICHITA NATIONAL BANK BUILDING
WICHITA FALLS, TEXAS

April 15, 1957

Mr. Gordon P. Street, President
The Wheland Company
Chattanooga, Tennessee

Dear Mr. Street:

I purchased one of your HP-14000 pumps five years ago which nas cut a tremendous amount of hole with virtually no repair expense.

This pump's performance was so satisfactory that when I began acquiring new machinery, bought a new HP-8000 pump for the smaller rig.

Both of these pumps are still in operation and doing a satisfactory job.

I operate two rigs in North Texas area. We drill contracts, interest deals and for our own account, from 2,000 - 8,500 feet.

Yours very truly,

J. W. HASTINGS DRILLING COMPANY

J. W. Hastings

FIRST PUMP'S RECORD SOLD THE SECOND!

5-YEAR RECORD

OF OUTSTANDING PERFORMANCE

"virtually no repair expense"

—J. W. Hastings

WHELAND HP-14000

7½" x 14" DUPLEX SLUSH PUMP

350 Horsepower Nominal Input at 60 RPM
Discharge pressure with 7½" liners 838 PSI
Discharge pressure with 5½" liners 1627 PSI
Dependable Operation • Lower Maintenance
Delivers more pressure per pound of pump!

Write for Detailed Bulletins

WHELAND

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CHATTANOOGA, TENNESSEE, U.S.A.

DRAW WORKS • SLUSH PUMPS • ROTARIES
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YOU CAN RECOVER OVER 80% PENTANES PLUS FROM LEAN NATURAL GAS

100 pounds of Davison Silica Gel adsorbs 1.5 to 3.0 gallons of hydrocarbons at 80% recovery efficiency

Why lose valuable hydrocarbons suitable for sale as gasoline, when you can recover them so easily with Davison Silica Gel?

This desiccant has high capacity for moisture and hydrocarbons, so minimum size equipment does the job. You'll find, too, that Davison Silica Gel is readily reactivated . . . gives low dewpoints . . . resists fouling . . . gives low pressure drop . . . is hard, tough, non-dusting and non-corrosive.

Why not get the whole story? See for yourself why Davison Silica Gel is ideal for natural gas dehydration and hydrocarbon recovery. Write today for literature.

Progress Through Chemistry

DAVISON CHEMICAL COMPANY

Division of W. R. Grace & Co.

Baltimore 3, Maryland

What Makes a Boom?

An oil boom, or any other kind of boom, springs from an idea . . . a good idea.

Patillo Higgins and Captain Anthony Lucas had one and the Spindletop Boom thus was born.

Dad Joiner had an idea and the great East Texas Field became a reality.

Who knows the extent of oil provinces under the seas? Or how much oil will be eventually produced below 30,000 feet? Booms aren't things that live only in history. They're always around. And more are sure to come.

But, booms are more than just ideas . . . they are actions based on careful planning. And, usually they're the result of more than one idea, more than one kind of action.

Take the Christmas Tree, for example . . . it's a part of the first East Texas boom, too—just as it is a vital part of the 1956 oil industry.

About the same time Dad Joiner made his first unsuccessful try in East Texas, O-C-T opened its doors—in an 18 x 20-foot shop in Houston.

By September 3, 1930, the date the famous wildcatter brought in the historic No. 3 Daisy Bradford, the men of O-C-T had followed up an idea with action.

Before the East Texas boom had a good start, they introduced the first factory-assembled, pretested Christmas Tree.

There had been Christmas Trees before, of course.

But these were often slipshod affairs, assembled on the spot with whatever material was available and noted more for their malfunctions than for performance.

O-C-T took the hit and miss out of well control equipment . . . put it on a mass production basis that guaranteed efficiency, economy and availability.

That was the first boom O-C-T participated in, but not the last.

Other ideas, other firsts followed fast.

The company introduced the first 10,000-pound test Christmas Tree . . . the first 15,000-pound test tree . . . the first casing head with an automatic seal . . . the first and only flow control that gives the advantages of both a choke and a valve . . . the first dual tubing string equipment . . . the first 30,000-pound test tree.

Booms aren't things only in history.

They're always around, although not always as spectacular as Spindletop or East Texas.

And more are to come.

Who knows of the oil provinces that lie under seas hundreds of feet deep?

Who knows of the oil provinces buried under 30,000 and 40,000 feet of earth?

There are booms yet to be written of.

And O-C-T plans to be there with the best equipment in the field . . . not when the booms are history . . . but when they're made.

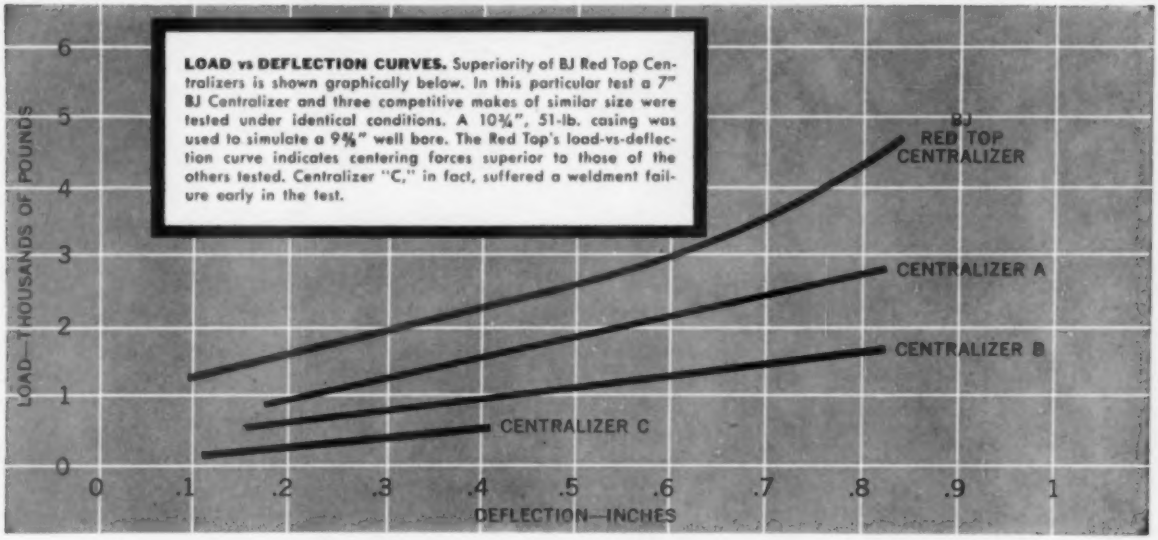
O-C-T

OIL CENTER TOOL CO.

A SUBSIDIARY of FOOD MACHINERY and CHEMICAL CORP.—Export Representatives: South America—East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

NEVER ANOTHER BOOM like East Texas perhaps, but somewhere around us there are other booms just waiting to be discovered. This is an East Texas scene when oilmen gathered to watch the Lathrop discovery come in near Longview, extending the field 27 miles from the Joiner well. (Photo from "East Texas Oil Field—The First 25 Years," by James A. Clark, courtesy Texas Mid-Continent Oil and Gas Association.

BJ Centralizers



LOAD vs DEFLECTION CURVES. Superiority of BJ Red Top Centralizers is shown graphically below. In this particular test a 7" BJ Centralizer and three competitive makes of similar size were tested under identical conditions. A 10¾", 51-lb. casing was used to simulate a 9⅞" well bore. The Red Top's load-vs-deflection curve indicates centering forces superior to those of the others tested. Centralizer "C," in fact, suffered a weldment failure early in the test.

Test results confirmed by an independent testing laboratory

Now for the first time there is tangible evidence of centralizer performance. A series of rigorous tests have been made upon stock samples of representative makes of casing centralizers used in the oil fields throughout the world. These centralizers were put through stresses that simulated the most grueling down-hole conditions. And in every case, BJ Red Top Centralizers outperformed all the competitive models tested.

These outstanding findings were far from accidental. With typical thoroughness, the Byron Jackson Division of Borg-Warner Corporation had subjected the BJ Red Top Centralizers to a battery of tests that were even more stringent than the subsequent independent project. The centralizers underwent several years of exhaustive study, design, tests, redesign, and more tests before they were offered to the petroleum industry.

Meticulous single-spring tests were made by BJ technicians to develop the best individual spring characteristics as well as the optimum resiliency of the assembled units. These tests were possible only because of BJ's exclusive *weldless, rivetless design,* which permits use of a higher quality alloy spring steel.

Only BJ Centralizers have the combination of features that guarantee you an efficient, trouble-free cementing program and maximum protection for your down-hole dollar. Get full particulars from your BJ field man or write Byron Jackson Tools, Inc.

best by test!

These points put BJ Centralizers on top in rugged competition

No load on casing! Springs fulcrum on cage. Casing always rotates freely.

Pre-stressed springs give higher initial load—assure maximum centering force with minimum set.

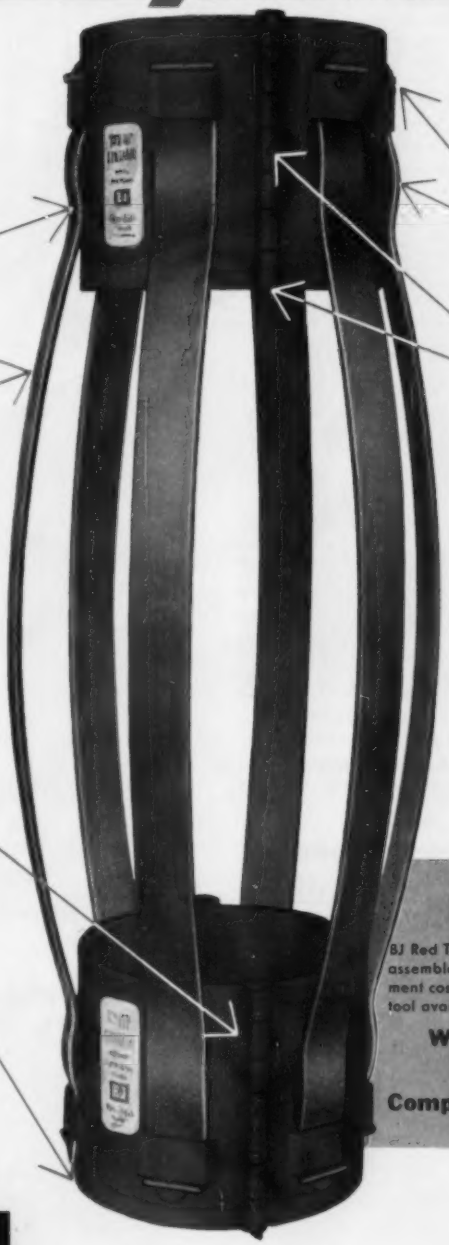
Rivetless, weldless construction makes possible the use of highest quality alloy spring steel...

Slim design allows easy insertion into the hole.

Hinged design offers quick, simple clamp-on.

End cages can't hit well bore, regardless of side load.

Choice of 1¼", 1½", 1¾" or 2" (color-coded) cambers.



Cambers dimensioned before pre-stressing and assembly. You always get the required assembled o.d.

Positive double retaining feature locks pin with dimple in middle and bend at end.

End of spring is curved so spring-holder can never hit wall.

Self-aligning, weld-on type stop collar furnished for use when centralizer is not located on casing collar.

Big Savings

BJ Red Top Centralizers can be shipped disassembled, offering big savings on shipment costs—particularly for export. Assembly tool available.

Watch for New Companion Tools

WATCH BJ FOR THE NEWEST

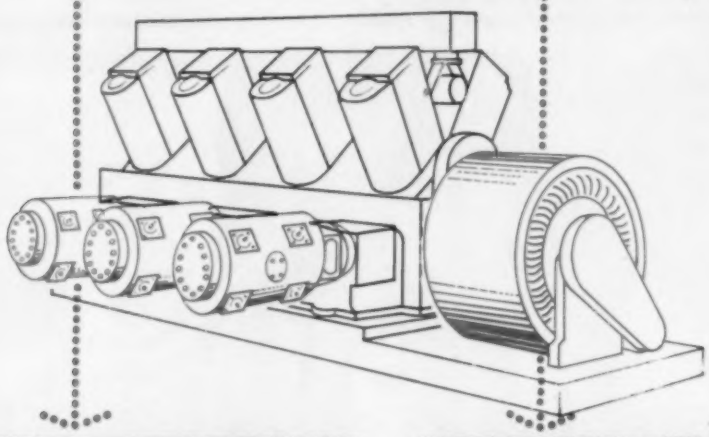
Byron Jackson Tools, Inc.

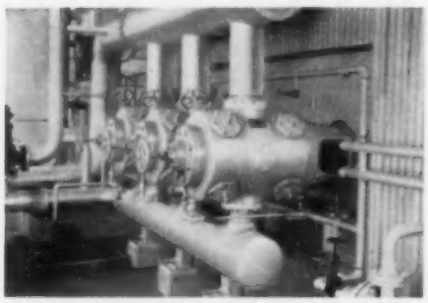
A subsidiary of Borg-Warner Corporation

P.O. Box 2017A, Terminal Annex · Los Angeles 54, California

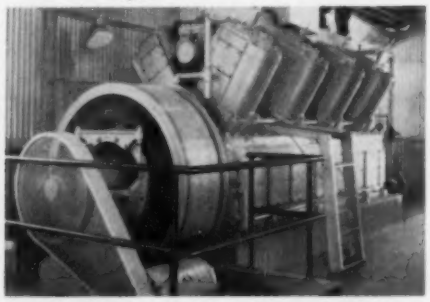
a COMPRESSOR in summer...

a GENERATOR in winter





Exterior view of compressor house at Reef Fields Gasoline Corp., Big Springs, Texas, showing compressor cylinders of the I-R gas-engine-compressor and generating unit beyond the firewall.



Interior view, showing the 275-kw generator on the I-R gas-engine-compressor and generating unit. Generator rotor provides proper flywheel effect when unit operates as compressor.

Double-Duty unit demonstrates versatility and smooth control of Ingersoll-Rand FOUR-CYCLE Gas-Engine Compressors

Why use two when one will do? The unusual combination shown above does two completely different jobs for the Reef Fields Gasoline Corp. It consists basically of an Ingersoll-Rand SVG gas-engine-compressor with an A-C generator in place of the usual flywheel.

In the summer months, this 440-hp unit is used as a refrigeration compressor. Its compressor cylinders boost propane gas to 200 psi, for use as a coolant in butane and propane recovery.

In winter when the refrigeration is not needed, the unit is put on full generator service. Its 275-kw generator alternates with four regular Ingersoll-Rand PVG gas-engine-generator units.

This double-duty application was made possible by the stability and smooth control inherent in every I-R 4-cycle, V-angle gas-engine compressor. The 4-cycle smoothness, so essential for A-C generator drive, also is important for compressor service: I-R units operate equally well from full load to no load and from full speed to half speed.

Whether you need *compression*, *generation*, or *both*, you're sure of smooth, dependable performance with an I-R gas-engine unit. Your Ingersoll-Rand representative will be glad to give you complete information and help you select the most economical unit for the job.

Ingersoll-Rand

6-688

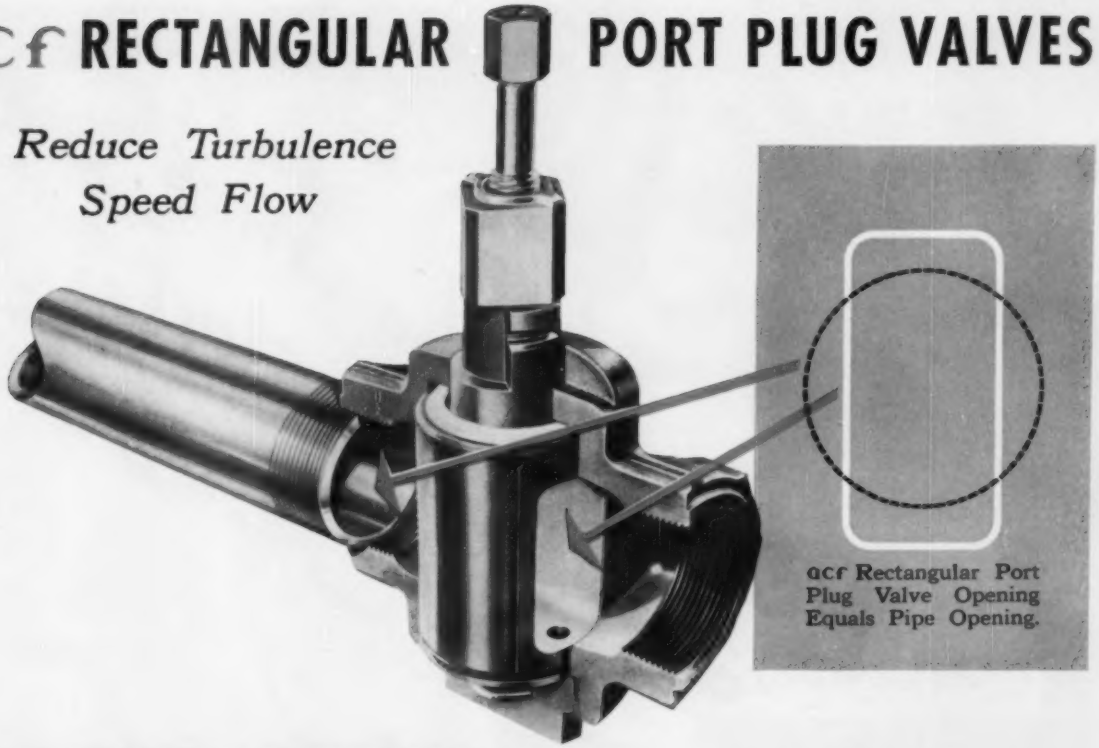
11 Broadway, New York 4, N.Y.

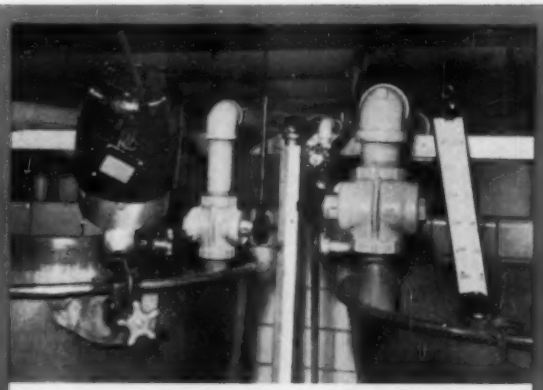
4-CYCLE V

COMPRESSORS • GAS & DIESEL ENGINES • PUMPS • AIR & ELECTRIC TOOLS • CONDENSERS • VACUUM EQUIPMENT • ROCK DRILLS

acf RECTANGULAR PORT PLUG VALVES

Reduce Turbulence
Speed Flow





acf Valves in food processing plant.

acf Valves on varnish tanks of large paint manufacturer.

Rectangular ports of acf® Lubricated Plug Valves are sized and shaped to provide the nearest approach to the flow efficiency of the pipe itself and still retain the most compact plug valve design.

In addition, the entrance chamber into the port is designed to permit the flow of fluid from pipe through plug with the least amount of turbulence and loss of head pressure.

Maximum flow efficiency is but one of the advantages you receive when you specify acf Lubricated Plug Valves. Others are: tight sealing without wedging or sticking—Teflon* head gasket—quick, quarter-turn opening and closing—precision lubrication—knife-edge shearing action of the plug. They all add up to low maintenance, long life for the industry's finest lubricated plug valve.

acf Valves are available through your industrial jobber or supply store.

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DIVISION OF acf INDUSTRIES INCORPORATED

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MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

*Teflon, tetrafluoroethylene resin. acf is a registered trademark of acf Industries, Inc.

Complete your file of vital valve data—write Dept. A-1111 for Catalog 400, containing sizes, pressures, specifications, design and performance factors of ACF Valves.

MANUFACTURERS OF W-K-M GATE VALVES acf LUBRICATED PLUG VALVES
KEY-KAST ALLOY STEEL PIPING FITTINGS KEY RETURN BENDS AND FITTINGS
5710

Bright highlight along lower face of ring shows pre-seated area from factory lapping.

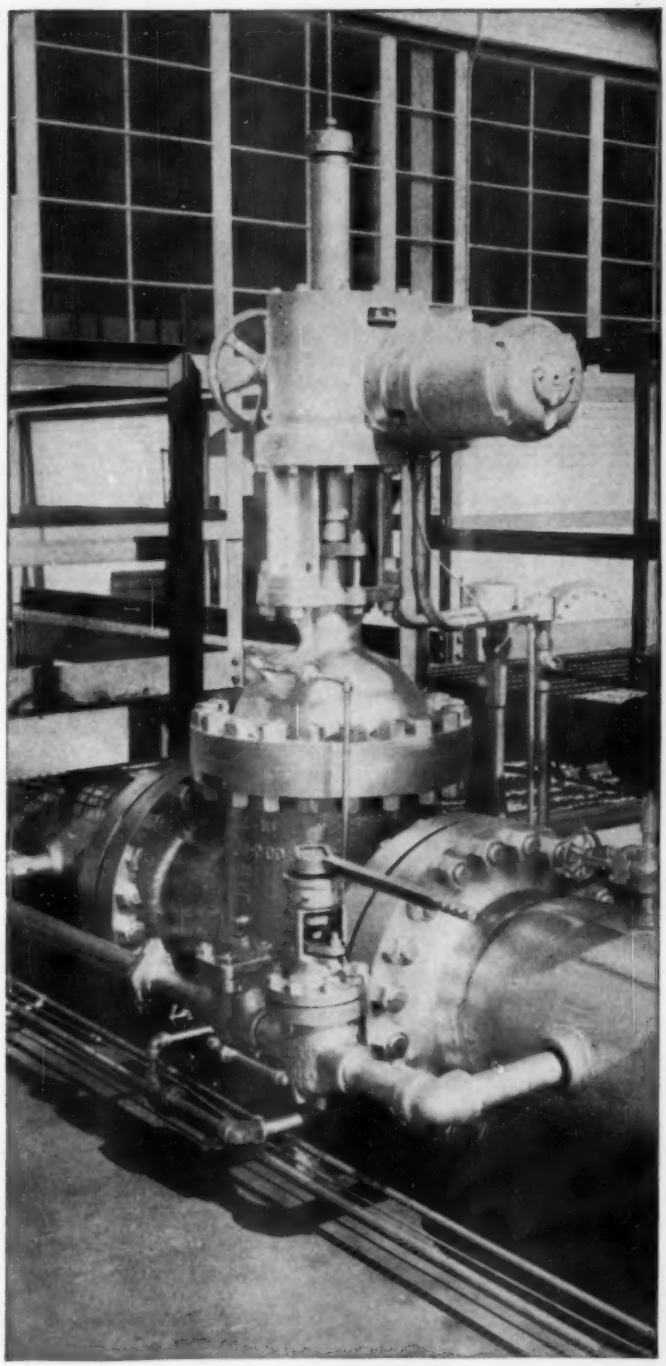
You have no long break-in period with PEDRICK Chrome Rings. Almost immediately you get the full benefits of the Chrome surface which is practically scuffless, which withstands high temperatures, abrasion and corrosion, and which increases ring life up to four times.

This is so because PEDRICK laps or pre-seats its Chrome rings to cylinder size at the factory. This reduces break-in time up to 80% and enables the engine to be put under full load very quickly, with all the benefits of Chrome. Furthermore, PEDRICK Chrome rings are the most-modern twist-seal or taper-face designs, which in themselves speed seating and assure a quick, positive seal.

So, for the very best in quality, the very latest in engineering design, make your rings PEDRICK. Let our engineers cooperate with you on special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, Penna., SAratoga 9-3770.

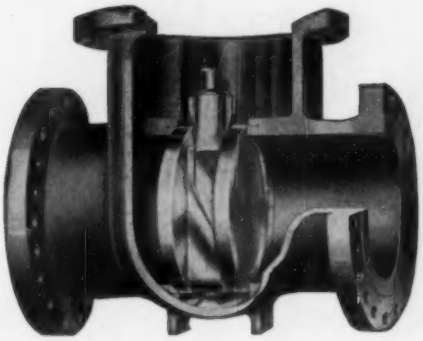
Pedrick PISTON RINGS

PEDRICK PIONEERED *Conformable* PISTON RINGS FOR BIG-BORE ENGINES



DARLING

fully-revolving double disc
pipe line gate valve



IDEAL FOR EFFICIENT CONTROL

Here's why

Operation is *consistently* trouble-free! Minimum friction, easy opening and closing, with self adjustment for positive closure. Wedging principle automatically compensates for any body deflection. Fully revolving discs avoid wear concentration. Discs and seats wipe clean with each operating cycle. In short . . . prolonged high efficiency with an extreme minimum of attention. It will pay you to give us an idea of your service needs and get specific details.

DARLING VALVE & MANUFACTURING CO.

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Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

Roebling Royal Blue Wire Rope goes to any length to prove its **high strength!**

Every inch of every foot of Royal Blue is stronger than any rope you've ever used on *any* job. This on-the-job tenacity helps to make it the most widely and readily accepted rope in Roebling's history. It is but one of Royal Blue qualities that makes for its long service life—on any job you choose. For full details on Roebling Royal Blue Wire Rope talk to your distributor or write to Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, for your copy of "*Wire Rope Recommendations and Catalog*."

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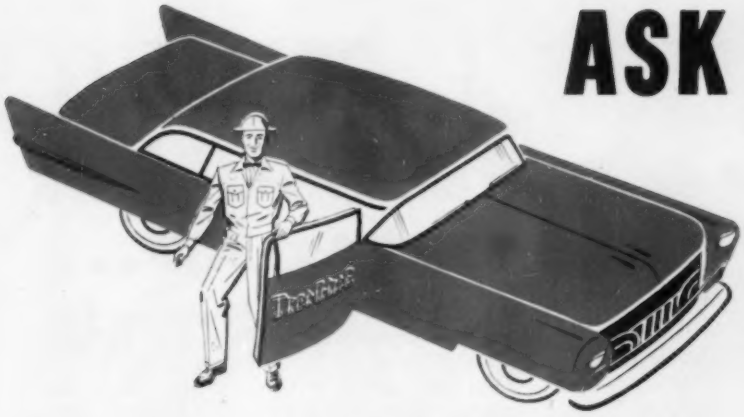

ASK THE MAN IN THE RED CAR

for fast, effective answers to your emulsion, corrosion, scale and similar treating problems

Whenever or wherever you see the Tretolite "Man in the Red Car" you are looking at an assistant for many of your field problems.

Not only is the Tretolite Field Engineer strategically located for your quick availability—he is adequately trained and equipped to recognize and effectively cope with most of your treating problems *right then and there!* His rear-of-car laboratory makes it possible for him to render on-the-spot analyses and suggested solutions for your treating problems.

Further, he is an important link in a well-forged, nationwide chain of men and facilities. He knows that he, in turn, is backed by the extensive research and technical experience of the Tretolite Company—always ready to advise, develop, or even send technical men into the field when necessary.

Why not present your very next field problem to

THE MAN IN THE RED CAR!

Chemicals and Services for the Petroleum Industry

DESALTING • DEMULSIFYING • CORROSION PREVENTING
SCALE INHIBITING • FUEL OIL ADDITIVES
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METAL CONDITIONERS

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THE HEAVIER THE LOAD...

the more you need HYATTS . . . because nothing else can equal straight cylindrical roller bearings for sheer load-carrying capacity. That's why many of the world's largest crawler tractors are equipped with HYATT Hy-Rolls.

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the more you need HYATTS . . . because they are precision-built with painstaking control of internal clearances to run smoothly even at 40,000 rpm, as in this Solar portable gas turbine pump developed for fighting fires.

THE MORE YOU NEED *Cylindrical* HY-ROLL BEARINGS

Heavier loads and higher speeds, which must often be accommodated in more compact housings than ever before, are causing problems for many a design engineer these days. If you're among those who are finding that previously-used bearings are no longer good enough, *it's time to switch to HYATTS.* In America's most complete line of straight cylindrical roller bearings you'll find space-saving separable types with ample capacity to carry your radial loads, or flanged race types which will take a surprising amount of thrust. When you lay in HYATT Hy-Rolls you make *sure* of longer, smoother performance at the lowest cost per hour of service. Ask your nearest HYATT Sales Engineer for recommendations —you'll find him mighty helpful! Hyatt Bearings Division, General Motors Corporation, Harrison, N.J.; Pittsburgh; Detroit; Chicago; and Oakland, California.

THE RECOGNIZED LEADER IN CYLINDRICAL BEARINGS

GM FORWARD FROM EIGHTY

HYATT HY-ROLL BEARINGS

THE "WORKHORSES" OF MODERN INDUSTRY

DU PONT *Petroleum Chemicals* NEWS

Number 81 in a Series of Bulletins for the Petroleum Industry

NOVEMBER 1957

New anti-icing additive offers economic advantage to refiners

YOU OUGHT TO KNOW...

JOSEPH G. EVANS is manager of the Petroleum Chemicals Division's San Francisco district, which includes the important northern California refining area near Du Pont's tetraethyl lead plant at Antioch.

Mr. Evans joined the Du Pont Company in December, 1951. He was at first assigned to sales service in the Mid-Continent region with headquarters in Tulsa.

Prior to this he was development engineer for a stoker company in western Pennsylvania, and later organized a company distributing industrial chemicals and specialized lubricants.

Mr. Evans is a graduate of Texas A & M. During the second world war he was an officer in the U.S. Navy, on submarine duty in the Pacific. He was recalled to active duty in 1950 and served two years on a destroyer off Korea. He is a member of the Society of Automotive Engineers, National Sales Executives and the Board of Directors of the San Francisco Sales Executives' Association.

Engine stalls caused by carburetor icing have become more annoying to motorists in recent years. This is because automatic chokes and transmissions on newer cars make it difficult to prevent stalls by "gunning" the engine, especially in heavy traffic. Power brakes and steering, less effective when the engine stops, make stalls a still greater problem.

THIS DEMONSTRATION DEVICE clearly shows the causes and prevention of carburetor icing. It consists of a small ice-cooled air intake and a 1.6-horsepower engine connected to it by a transparent manifold. When unprotected gasoline is drawn through the tube, ice visibly forms and causes the engine to stall. But the addition of DMF to the gasoline maintains constant, ice-free carburetion.

More and more refiners are now using additives in gasoline to prevent carburetor icing. One of the most effective is Du Pont DMF (dimethyl formamide) antistall additive. It is economical; only a little is required for protection. In many instances, less than two milliliters of DMF per gallon of gasoline are needed to keep carburetors ice-free. Therefore DMF is economical to ship, to store and to add to gasoline.

(Continued)

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT *Petroleum Chemicals* NEWS

CONTINUED

Anti-icing additive

Marketing advantages

Since motorists are becoming increasingly aware of carburetor icing and the stalling annoyance it causes, you can profitably feature your use of DMF in advertising and promotion campaigns.

To help you capitalize on the motorist benefit of DMF, we have prepared a number of sample ads, poster designs and sales aids (shown above). These dramatize the anti-stalling advantage of gasolines containing DMF. The ideas can be incorporated in your advertising.

Just drop us a line or get in touch with any Petroleum Chemicals Division representative.

In 1956 Du Pont spent $48,000,000 in Texas

During 1956, more than 2,000 Texas firms sold over $30,200,000 worth of goods and services to Du Pont plants in Texas. During the same year, Du Pont payrolls in Texas amounted to more than $17,700,000.

The purchases included raw materials used in chemical manufacturing . . . natural gas, butadiene, propane, ammonia, chlorine, caustic, ethylene, cyclohexane, lubricating oils, and nitric, acetic and sulfuric acids.

Small business concerns supplied many of the more unusual items and services, such as embroidery hoops and cotton gun patches used in analytical work. And a group of Texas oil well drilling experts was retained by the Victoria plant to perforate the steel casing in a 5,000-foot brine disposal well.

Watch the Du Pont "Show of the Month," CBS Network

Importance of credit cards pointed up by findings of new Du Pont survey

What do people really think about oil company credit cards? Finding the answer to that question was one of the objectives of a new study of service station customers' motivations recently completed by National Analysts, Inc., Philadelphia, for the Du Pont Petroleum Chemicals Division.

The survey revealed that 58% of the 2,036 motorists interviewed were favorably disposed toward the credit card principle. Only 16% were opposed, while 26% were undecided. Apparently *this* group is ripe for credit card promotion. An earlier Du Pont survey showed that credit card customers are more loyal to one brand of gasoline than those who do not buy on credit.

Here's why . . .

The new Du Pont survey probed also into the reasons why customers are predisposed toward credit cards. Card holders gave varying reasons for using them: for example, that they were convenient to have on trips and that they enabled motorists to buy gasoline when short of cash. A few card holders retained oil company invoices as records of gasoline and oil purchased.

In spite of the fact that the majority of service station customers' attitudes toward credit cards were favorable, only 18% of all motorists had cards. Of these, 13% had one and 5% had cards from more than one company.

Motivations vary by region

The national survey report has been analyzed to determine regional differences of habit and opinion.

These of course will prove of interest to all oil company marketing men, but especially to those with only regional distribution.

Credit cards are more widely accepted and used in the west coast and southern states.

Such information is but a small part of this new survey. The complete findings have been published in the new book, "Buying Patterns at Service Stations," now being distributed to oil company marketing executives. Requests from others in the industry will be welcomed and filled promptly.

SALES OFFICES

Chicago 3—8 So. Michigan Ave. . . . RAndolph 6-8630
Cleveland 15—25 Prospect Ave. . . . SUperior 1-1363
Denver 2—Petroleum Club Building, 16th & Broadway . . . . . AComa 2-2347
Houston 2—705 Bank of Commerce Bldg. . . . . CApitol 5-1151
Los Angeles 17—612 So. Flower St. . MAdison 5-1691
New York 20—1270 Ave. of the Americas . . . . COlumbus 5-2342
Philadelphia 2—3 Penn Center Plaza . LOcust 8-3531
Pittsburgh 22—1 Gateway Center . . . ATlantic 1-2933
San Francisco 4—111 Sutter St. . . . EXbrook 2-6230
Seattle 3—4003 Aurora Ave. . . . . MElrose 6977
Tulsa 1—1811 So. Baltimore Ave. . . . LUther 5-5578
In Canada—Du Pont Company of Canada (1956) Limited, Petroleum Chemicals, 85 Eglinton Ave. East, **Toronto 12**—Ontario . . . . . HUdson 1-6461
In Other Countries—Organic Chemicals Department, Export Division, 7447 Nemours Bldg., Wilmington 98, Del., OLympia 4-5121, Ext. 2962.

DU PONT
REG. U. S. PAT. OFF.

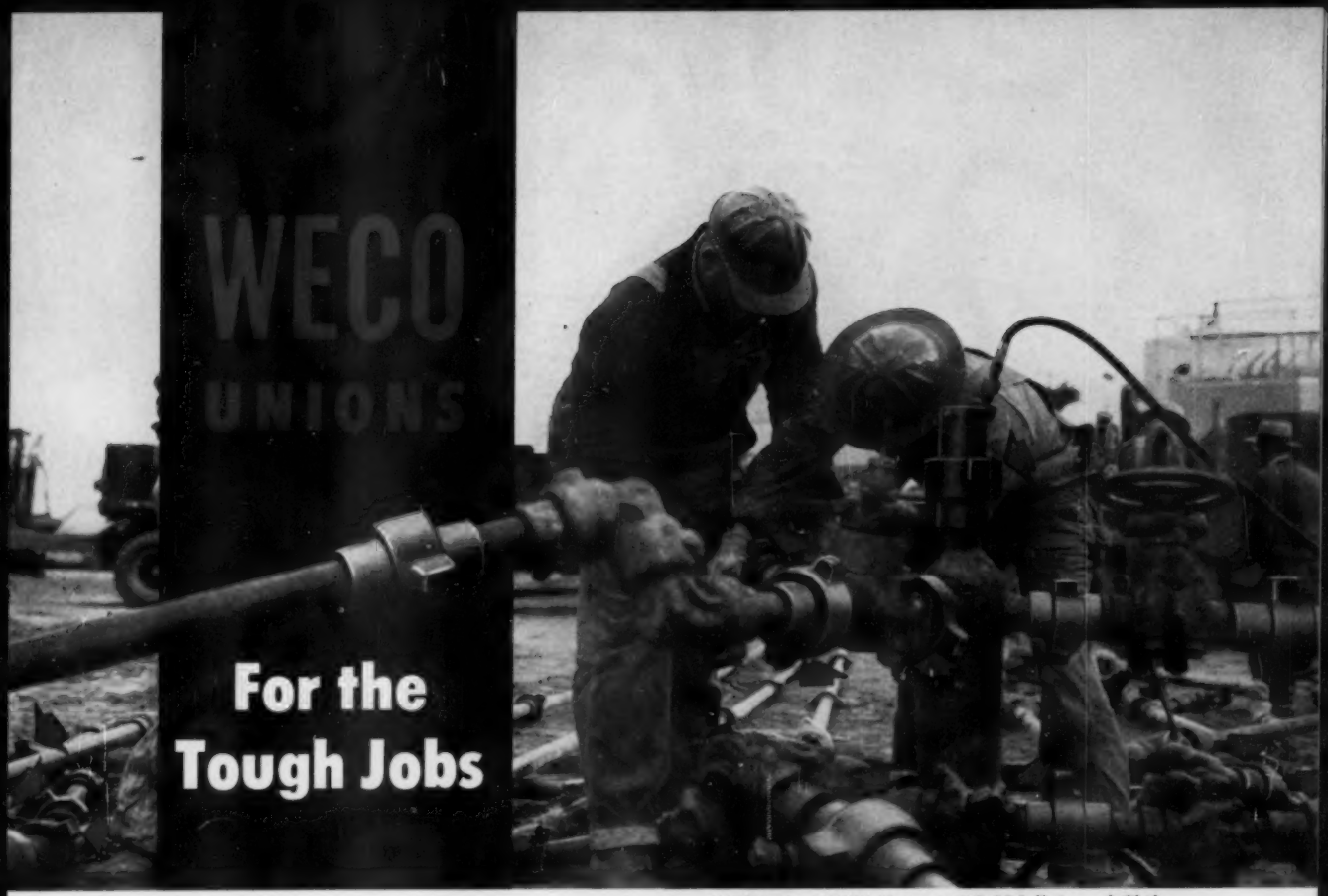
Better Things for Better Living . . . *through Chemistry*

DU PONT TETRAETHYL LEAD AND OTHER PETROLEUM CHEMICALS

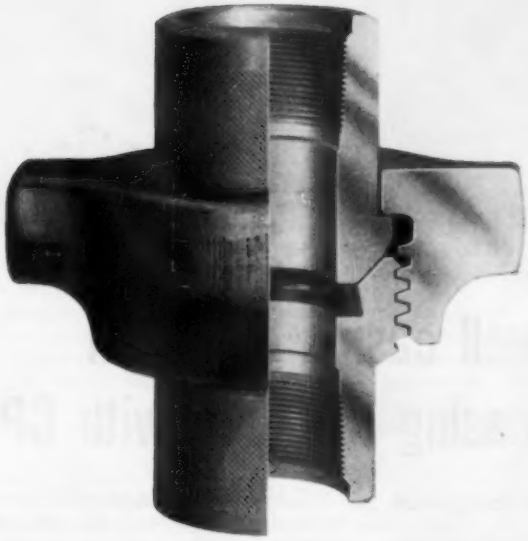
ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

Printed in U. S. A.



WECO Fig. 1502 Unions (15,000 lb.) and Chiksan XHP Joints (15,000 lb.) in use on a fracturing job.



During the course of fracturing, cementing or acidizing operations, fittings and equipment are subjected to extremes of pressures, volumes and abrasion.

And that's when WECO's reputation for sealing and service has real meaning. Tough WECO Unions take the strain of the severest service as part of a regular day's work. Their famous ball and cone seat forms a metal-to-metal seal that refuses to leak under high pressures, shock, surge or vibrations. Their stronger subs and wing nuts, their heavier wall construction, and Acme threads take the toughest treatment as a matter of course on job after job.

It stands to reason: A union that can withstand the toughest service jobs can do a better job for you!

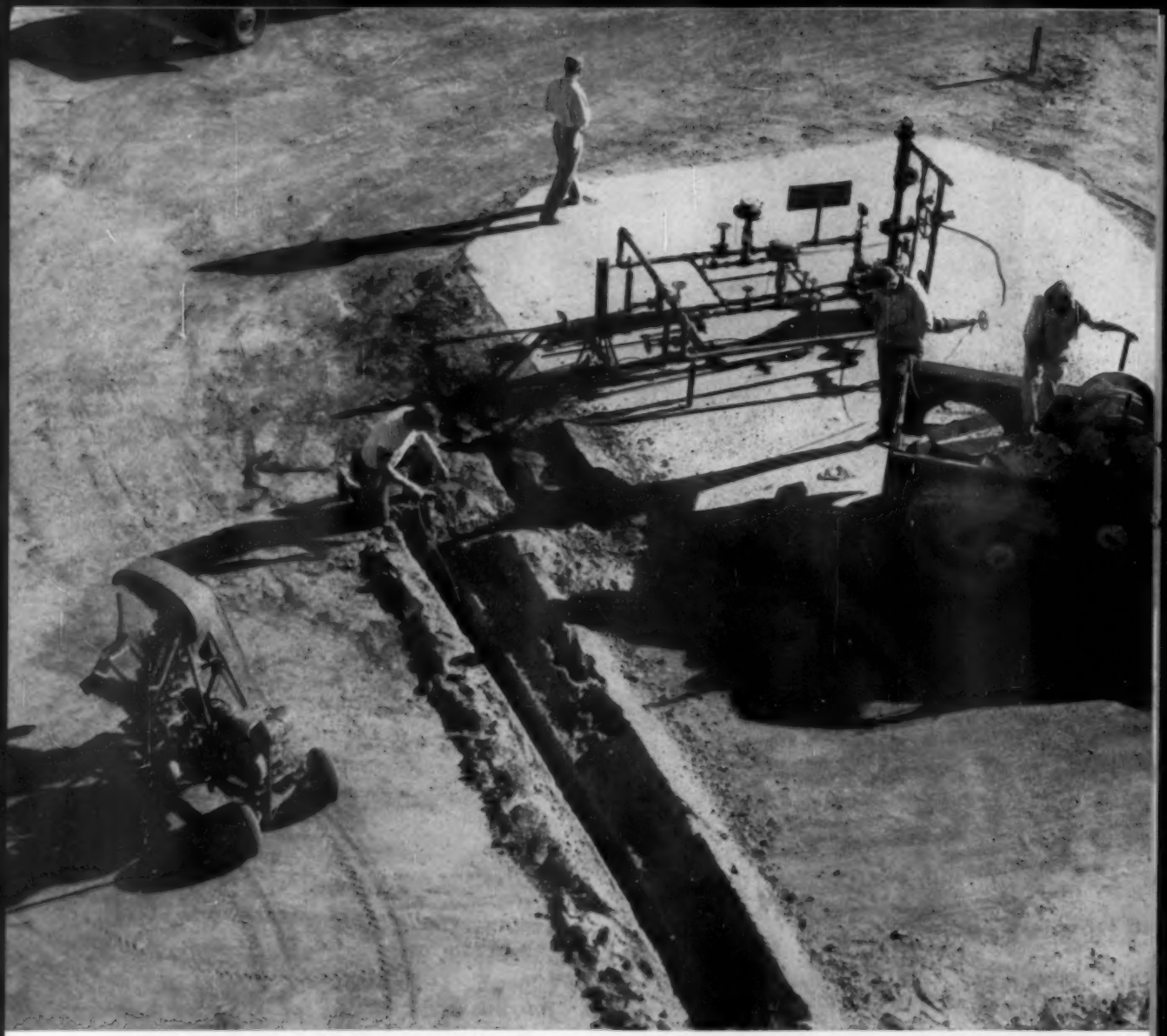
U-3-57

WECO®

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

fmc



Anaconda Type CP Cable is laid in trench to oil well casing to be protected by cathodic protection. Continental's entire 163-well lease at Ventura, Calif., has been protected with a CP system.

Oil company checks oil well casing corrosion for less than the cost of 3 casing failures—with CP

Anaconda's special Type CP Cable is used throughout.

The corrosion problem at Continental's 163-well lease at Ventura, Calif., was pretty typical: 15 casing failures in 3 years. Cost of repairs—from $22,000 to $61,000 a well—averaging about $125,000 a year for the 3 years that corrosion has been a serious problem.

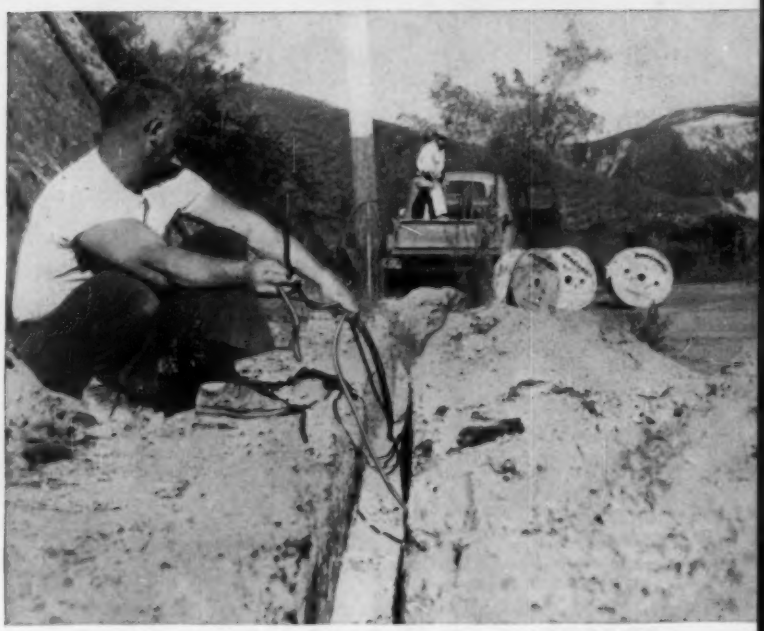
In May, 1954, Continental engineers began investigating cathodic protection to protect oil well casings. One well was set up with cathodic protection — and after six months, a visual examination and an electrical survey showed a definite lessening of corrosion potentials.

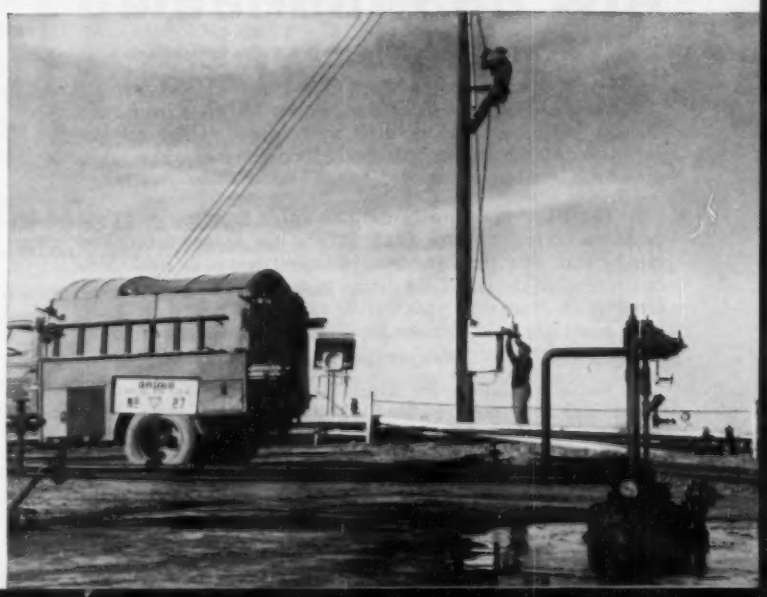
Last year, cathodic protection was expanded to all 163 wells—the first time an entire lease has been protected against corrosion of oil well casings by CP. The cost: $109,000—less than the cost of 3 casing failures.

Heart of the CP system is 49,000 feet of Anaconda's Type CP Cable. Designed *especially* for cathodic protection, Type CP Cable promises longer cable life because of resistance to oil, soil acids, and electroendosmosis.

The Man from Anaconda will be glad to give you more information on cathodic protection for oil well casings and other metal products—as well as complete data on Anaconda Type CP Cable. Call or write today: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 57387

SEE THE MAN FROM ANACONDA®





(above, right)
Three anodes—3-by-60-inch shafts of graphite—were used for each casing, buried 10 to 15 feet apart and 11 to 30 feet deep. When wells were grouped, the number in the common field was cut. Here, one worker prepares to lower anode in hole while second man holds bag of carbon coke.

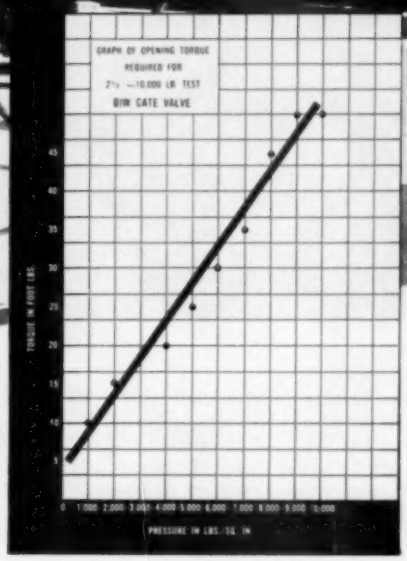
(middle, right)
After ditch-digging machine carved out 18-inch trench, Anaconda's special Type CP Cable was buried in the ditch, connecting the rectifier on base of power pole to anode bed and well head. In some nearly vertical areas, cable could not be buried—but Anaconda's tough Densheath* jacket protects it from sun, wind and rain.

(bottom, right)
Final Step — juice from overhead lines was connected to the CP system.

*Reg. U. S. Pat. Off.

for Type CP Cable

No Grunt, No Cheater, No Strain



BIW non-lubricated gate valves

These are the valves that always open and close easily, and without the expense of periodic maintenance. These are the valves that are always *ready* to open or to close easily. The graph shows the low torque required for operation *under pressure.*

The BIW non-lubricated gate valve frees you from the problems of maintenance. Once in, you can forget them. You can be sure that the tight metal-to-metal seat will hold. You can depend on the simplified design to give you years of trouble-free service. More than 35,000 BIW valves in the field are doing their best right now. Get the best in maintenance-free, trouble-free valves for your wells.

ALCO specialists are available to show you the BIW Valve and the entire BIW Christmas tree. Or write ALCO Products, Inc., Petroleum Industry Equipment Division, Dept. BV-3, Bank of the Southwest Building, Houston, Texas.

ALCO

ALCO PRODUCTS, INC.

NEW YORK

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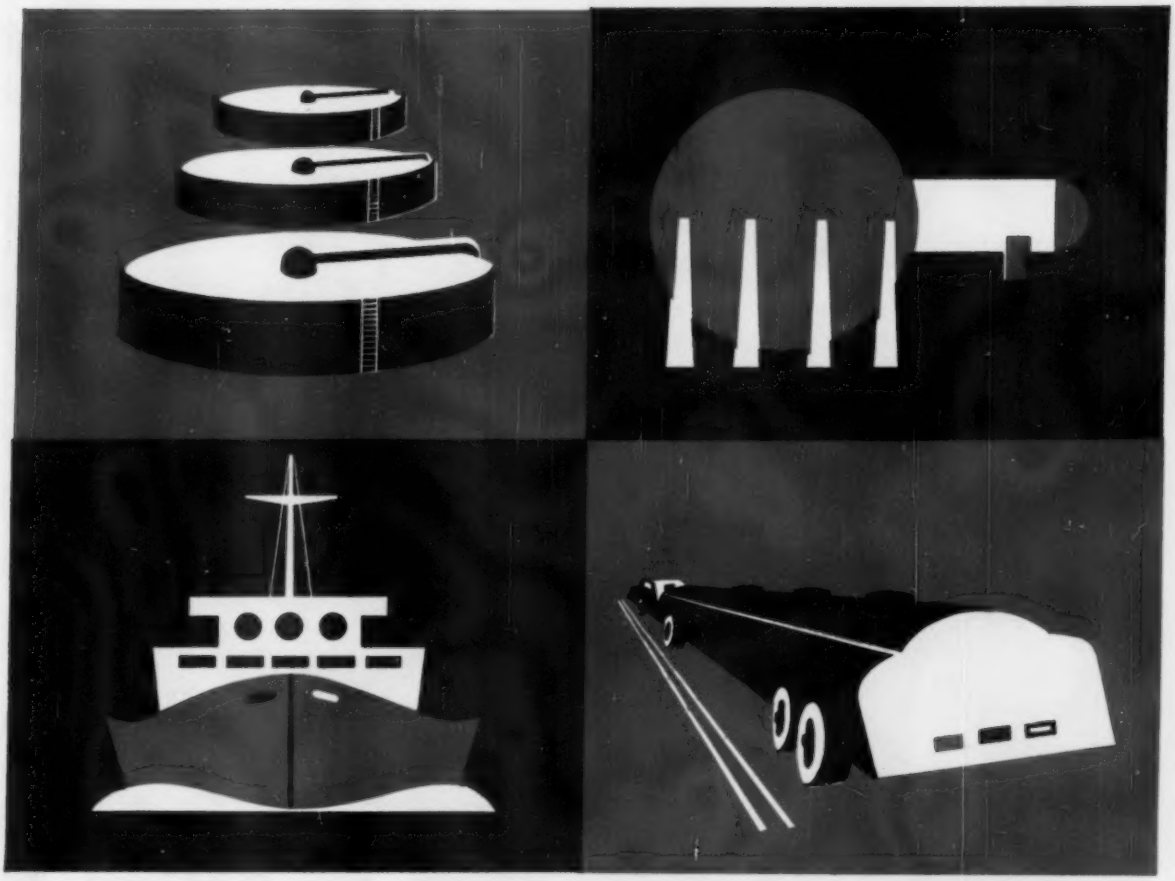

World's most complete line of Storage Tank Fittings

Only Shand and Jurs offers world-wide availability and service on mechanical fittings — vents, gages and valves — for storage tanks. Stocks are maintained in key cities for prompt delivery to your tank farm, yard or depot.

Proved by over 36 years service, S&J tank fittings have set the industry standard for economy, safety, accuracy and dependability. Call or write your nearest S&J office for catalog and prices on the type of fittings you need.

S&J is also a world-leader in the manufacture of electrical remote supervisory control equipment.

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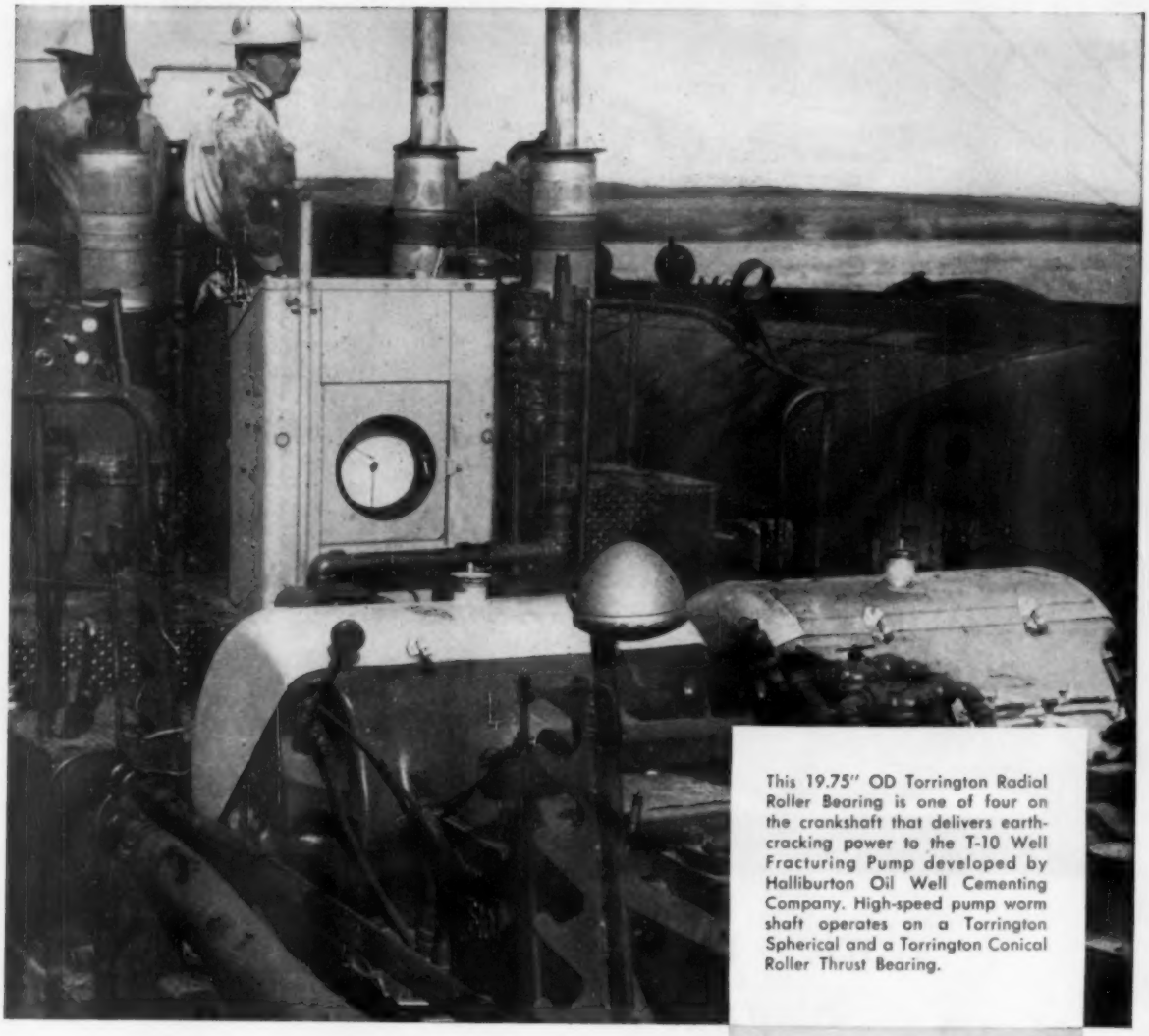
4440



This 19.75" OD Torrington Radial Roller Bearing is one of four on the crankshaft that delivers earth-cracking power to the T-10 Well Fracturing Pump developed by Halliburton Oil Well Cementing Company. High-speed pump worm shaft operates on a Torrington Spherical and a Torrington Conical Roller Thrust Bearing.

Controlling a man-made earthquake!

Millions of barrels of oil are being added to our recoverable resources by "fracturing"—a controlled, man-made earthquake. Sand-carrying fluid is pumped into a well with enough pressure to crack and enter a formation. Sand remains to prop open the new fissures.

Pressure is applied through a Halliburton T-10 Well Fracturing Pump. Mounted on the crankshaft of this pump are four Torrington Radial Roller Bearings. There they render dependable service and meet the demanding requirements of severe space and weight limitations.

The precision construction, quality steels and skilled heat treatment that go into Torrington Bearings have made them rugged, dependable performers in all types of oil-field equipment. Call on your Torrington representative for engineering service in the application of anti-friction bearings to your heavy-duty equipment. **The Torrington Company, South Bend 21, Ind.—and Torrington, Conn.**

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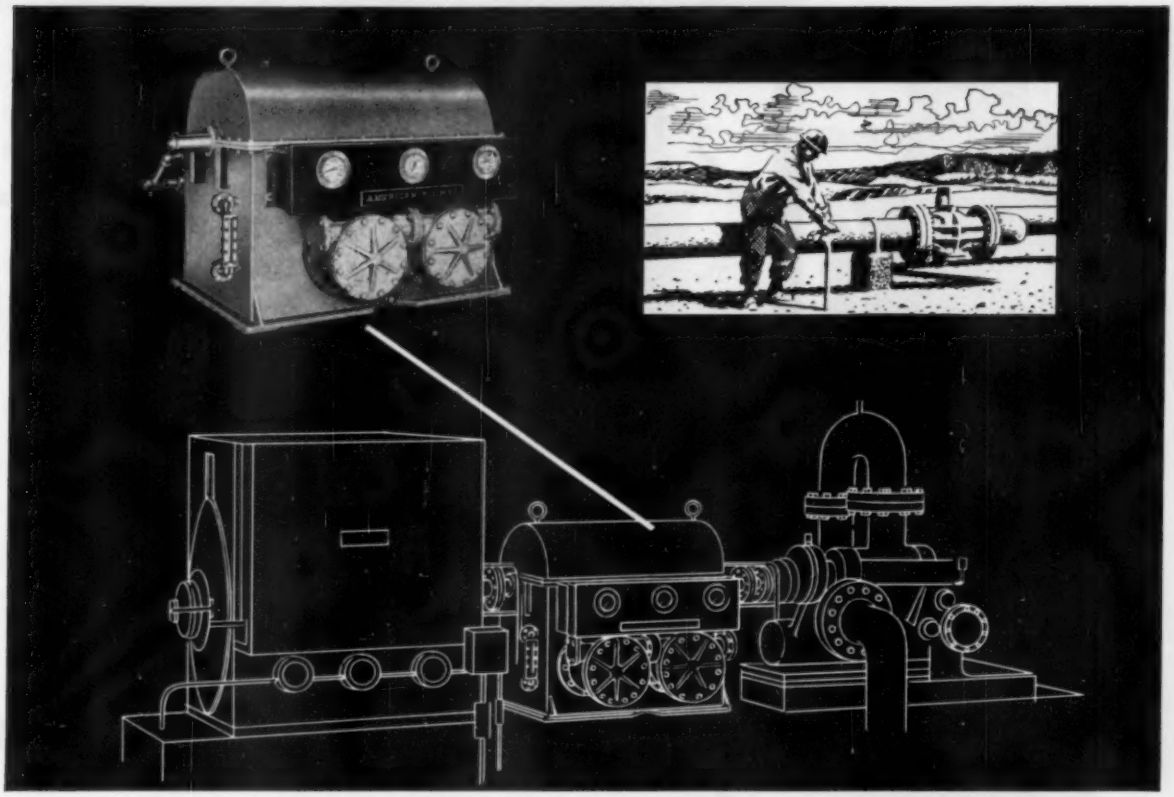
AMERICAN BLOWER *Gyrol*® FLUID DRIVE...



Class 6 Type VS Gyrol Fluid Drive, 250 hp to 12,000 hp, speeds to 3,600 rpm.

How to get more through-put per kw consumed at pipeline pumping stations

You save power dollars in pipeline pumping stations with American Blower Gyrol Fluid Drives. Used with standard, single-speed induction motors, the stepless, adjustable-speed Gyrol units control pump flow and pressure to give the desired output at the lowest power consumption.

For many years, the dependable Gyrol Fluid Drive has satisfied the automation requirements of the power plant industry for driving centrifugal boiler-feed pumps and fans. Now, the same reliable Gyrol Fluid Drive is providing the ideal means of remote-controlled power transmission for the centrifugal pumps in unattended pipeline pumping stations.

Whether you're pumping a single product or multiple products of various densities, here's how you benefit with the Gyrol Fluid Drive:

- Lower demand charges
- Power savings by adjustable pump speed
- No-load motor starting
- Wide range of pump control, permitting complete flexibility whether one or several products are being pumped
- The use of standard induction motors and Gyrol Fluid Drive to provide a safe, dependable power combination

Call your American Blower branch office for full information; or write: American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

Division of American-Standard

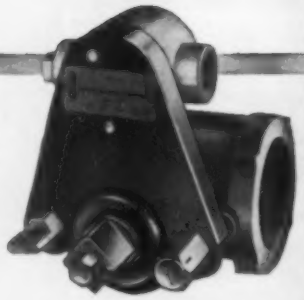
Automatic TANK

ENGINEERED LEASE CONTROL SYSTEMS DESIGNED TO MEET INDIVIDUAL LEASE REQUIREMENTS

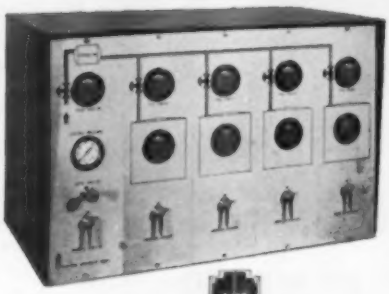
The CSC Model DL-G Electric Automatic Tank Switcher, shown at right, is available for switching from two to twenty tanks, enables the lease operator to have completely automatic tank battery operation.

One inlet valve opens at a time, filling tanks in sequence. When a tank is full, its inlet valve closes and the fill valve of the next available tank in sequence is opened. Tanks already full or being run to pipeline are automatically skipped. A lock-out switch on each custody valve eliminates the possibility of filling into a tank while it is being run to the pipeline. Tanks can be selectively locked out of the sequence circuit by means of manual switch. Cleaning or repair of a tank can thus be accomplished without interfering with the automatic operation of the tank battery. If all tanks become full or otherwise unavailable for filling, the controller will open a power circuit or close an alarm circuit.

Graphic symbols are etched in aluminum and are colored. Indicating lights are also color coded. The controller operates with 115 volts, 60 cycle power.



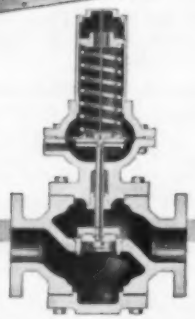
The CSC Pipeline Valveswitch was designed for use in automatic tank batteries. A Valveswitch mounted on each tank pipeline valve acts as an electrical interlock with the electro-pneumatic or electric inlet valve. In this capacity the Valveswitch will prevent the inlet valve from opening when the pipeline valve is open.



Type 3100 Pneumatic Tank Switcher. Where electric power is not available, tanks may be switched automatically by means of the Pneumatic Tank Switcher pictured to the left. The operating sequency is substantially the same as that for the electric tank switcher. One inlet valve opens at a time, filling the tanks in sequence. When a tank is full, its inlet valve closes and the fill valve of the next available tank in sequence is opened. Tanks can be selectively locked out of the sequency by means of a manual valve on the panel. Should all tanks become full or otherwise unavailable for filling, the controller will exhaust pressure from the diaphragm of the safety shut-down valve in the main flow line.

Manual control of the pneumatically actuated fill valves is possible by operating selector valves on the control panel. The graphic control panel is provided with indicators showing fill valves "open" or "closed" and tanks "full" or "empty".

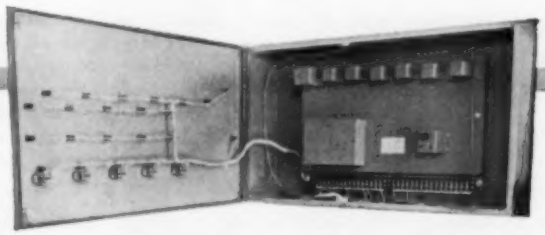
Sequential switching is accomplished by means of a vacuum-motor driven cam, operating tank selector pilot valves. All pilots and relays are standard Fisher items.



Fisher Type 1563 Tank Switching Valve shown above is designed for use on automatic tank battery control applications where tight shut-off, large capacity and compactness are required.

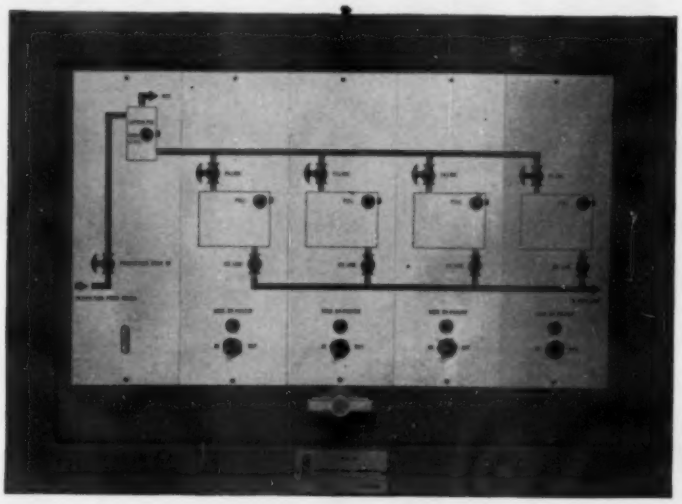
The valve can be supplied with a solenoid valve mounted on spring case for translating electrical signal to pneumatic output.

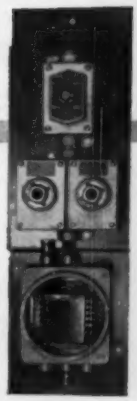
Seat and inner valve construction are designed to operate at pressure drops well in excess of the 125 lb. pressure rating. A composition "O" ring valve seat is utilized to give absolute tight shut-off.



Internal layout of Type DLG Tank Switcher. All relays and stepping switch are hermetically sealed, and plug-in, greatly reducing chances of component failure due to dirty or corrosive atmosphere, and at the same time making maintenance simple.

SWITCHING



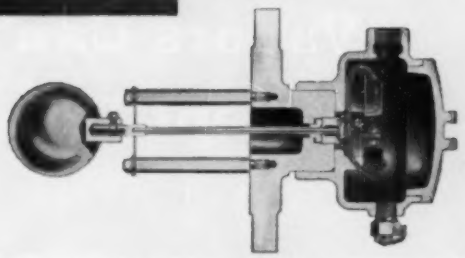


Type RB2-EP Explosion-proof Two Tank Switcher. Where only two tanks are to be switched, the CSC RB2 Tank Switcher affords a simple and economical means of control. Available in dust-tight, weather-proof or explosion-proof housing, this panel provides pilot lights to indicate which tank is filling and a safety circuit to provide actuation of lease shut-in equipment if neither tank is available for filling. Relays are hermetically sealed into one plug-in unit.

OTHER EQUIPMENT AVAILABLE

- Automatic Custody Transfer Controls
- Automatic Well Test Controllers
- Data Print-out Devices
- Telemetering for Lease Control

For details, write Control Specialty Corp., Box 4524, Houston 13, Texas



The Fisher Type 2800-252V is an on-off type of float switch operating on the displacement force principle whereby a changing level produces a force change due to the buoyancy of the float. The float is attached to a flexure tube assembly which is secured to the housing assembly by the flexure tube retainer. Flexure tube retainer provides the fulcrum over which the movement of the float is transmitted to the Microswitch.

Type 2800 pilot incorporates Microswitch action in an explosion-proof housing. Also available with Type 2805 pneumatic snap-acting pilot-interchangeable on same housing.

CSC

FOR CONTROL SYSTEM DESIGN:

CONTROL SPECIALTY CORPORATION

(A Subsidiary of FISHER GOVERNOR COMPANY)

Box 4524, Houston 13, Texas

FOR VALVES AND LIQUID LEVEL CONTROLS:

FISHER GOVERNOR COMPANY

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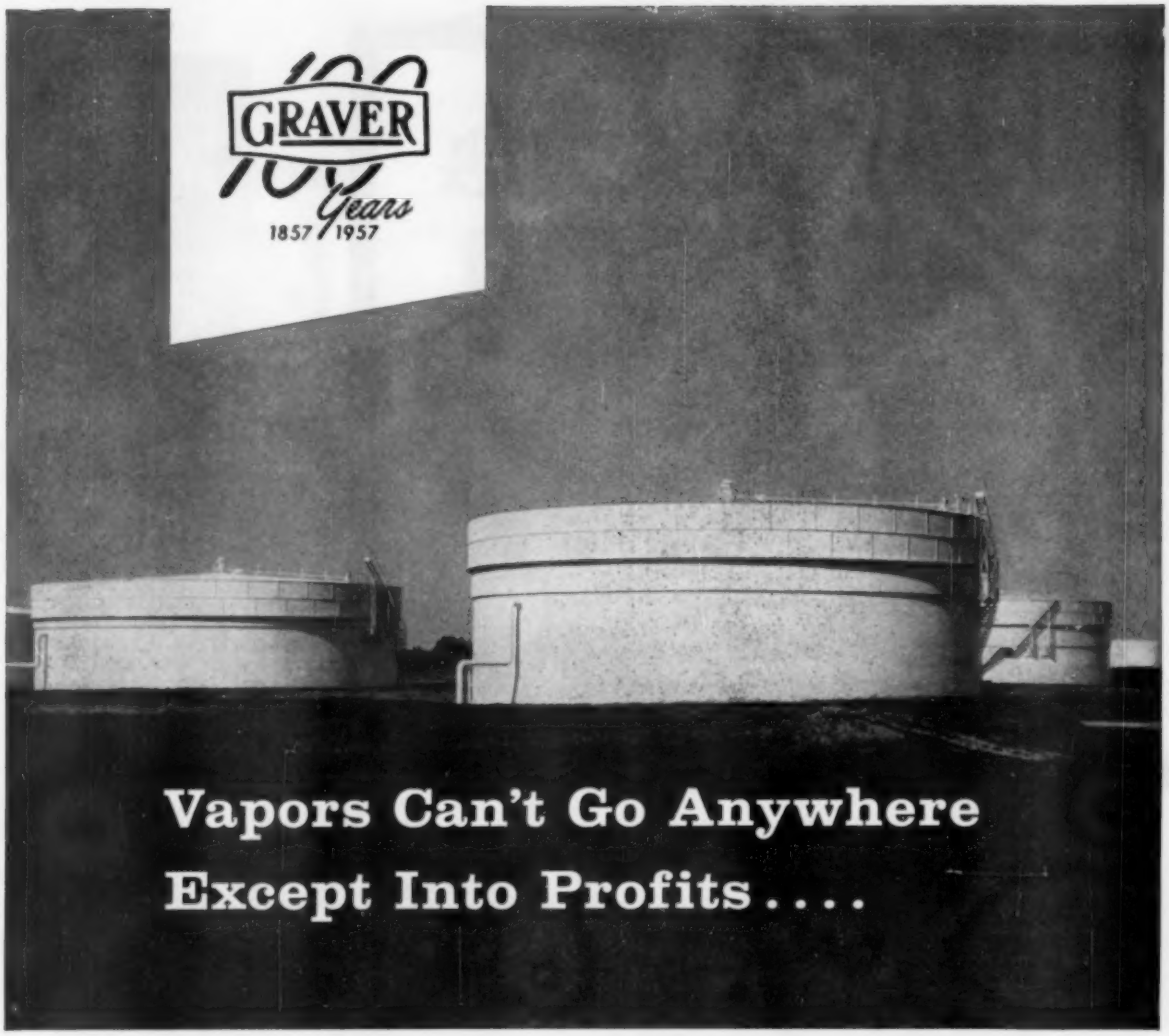
FISHER® Controls

SINCE 1880



WITH THE ROOF THAT BREATHES!

Your vapor-loss control projects find ready solution when turned over to Graver—champions of vapor conservation since the turn of the century.

For example, the efficiency of the vapor-control method provided by the patented Graver Expansion Roof® Tank has long been recognized as the most effective method for minimizing gasoline vapor losses.

This trouble-free roof virtually breathes vapors back into profits. As vapors form, the roof ascends. As they condense, the roof descends. Reabsorption of vapor is speeded by the weight of the roof. No other lifter roof matches the operating smoothness of the Graver Expansion Roof.

The volume of vapor space afforded by the 10 foot lift is ample to protect not only the contents of the Expansion Roof Tank itself, but also the product stored in adjacent manifolded cone-roof tanks as well.

If your problem is that of providing against vapor loss during the storage of product—or volatile crudes or chemicals—in single or multiple-tank installations, the Graver Expansion Roof Tank is the key to profitable operations.

GRAVER®

Building for the Future on a Century of Craftsmanship in Steels and Alloys

GRAVER TANK & MFG. CO., INC.
EAST CHICAGO, INDIANA
New York • Philadelphia • Edge Moor, Delaware • Pittsburgh
Detroit • Chicago • Tulsa • Sand Springs, Oklahoma • Houston
New Orleans • Los Angeles • Fontana, California • San Francisco

One of many reasons why **ALLIS-CHALMERS MOTORS** are preferred for outdoor applications in the

PETROLEUM INDUSTRY

Space Heater is weather protected

(and corrosion-proof!)

Weather protected motor drives pipeline pump.

Weather-protected heaters are standard on Allis-Chalmers outdoor motors . . . prevent moisture condensation on motor parts during shutdown periods. These immersion-type heaters are not only waterproof, they are also stainless steel clad for resistance to corrosion.

Easy Maintenance, too!

Heater terminal box mounts outside motor frame; heating element projects into motor enclosure. Open wiring inside motor is eliminated. Entire heating unit is easily removed for service or replacement.

For details on this and all the other outstanding features of Allis-Chalmers motors, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwauke 1, Wisconsin.

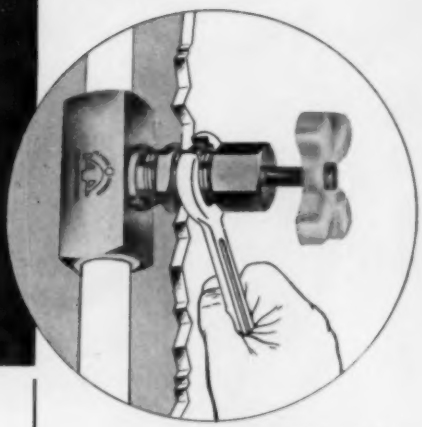
A-C ALLIS-CHALMERS

ALLIS-CHALMERS

A-5492

For panel mounting with double female connections.

For panel mounting with male inlet; female outlet.



A quick, trim panel mounting with a twist of a wrench.

Panel mounted in seconds!

Did you know that the best needle valve is also best for panel mounting?

Look at the valves above . . . specifically designed for panel mounting. No holding fixtures are needed. Simply remove the packing nut and one of the holding nuts; slip the stem through the panel opening and reassemble. The valve handle is packed separately to speed up the job — literally done in seconds.

You get a neater installation at lower cost . . . just one more proof that we have thought of everything in the Marsh 1900 series. Note the unduplicated features opposite. Ask for Needle Valve Catalog covering all details.

MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corporation* **Dept. L, Skokie, Ill.**
Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta
Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas

MARSH *Needle Valves*

Standard globe pattern with double female connections.

Standard angle pattern with male inlet; female outlet.

Standard angle pattern with double female connections.

Standard globe pattern with male inlet; female outlet.

MARSH

The ultimate in Needle Throttling Valves

All Marsh Needle Valves — for both panel and standard mounting — share these features that are combined in no other valves.

- **Maximum working pressure: 10,000 psi** — for water, oil, or gas. Equally effective in lower pressure ranges.
- **One piece.** Body and stem-guide are fused into one piece by Marsh "Conoweld" process. No danger of stem leaking or blowing out.
- **Precision machined and ground stem** —of 416 stainless steel. Easier to operate at higher pressures.
- **Finer regulation**—provided by long fine stem threads which also give added strength.
- **Machined from heavy bar stock**— Both body and stem-guide. Sturdiest basic construction known.
- **Deep "Marpak" packing**—longer lasting; easier to renew.
- **Deep throats and thread chambers** —for tight make-up of piping.
- **Handsome appearance**—Electro zinc plated body, set off by sturdy malleable iron handle finished in heavy, attractive, yellow baked enamel.
- **Clear markings.** Bodies marked in accordance with M.S.S. regulations showing size, material, service symbol, maximum pressure.

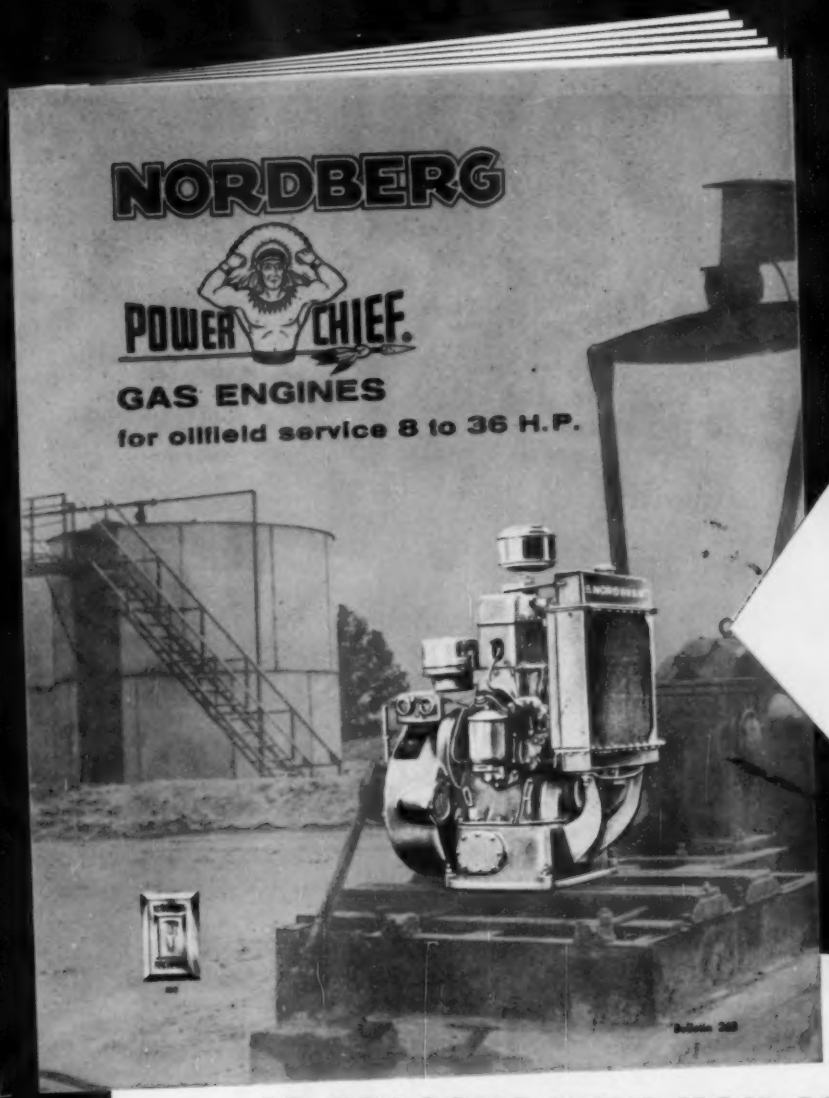
Marsh Needle Valves for Special Applications

For high pressure air service, Series R1900, hardened stem, Marpak packing system.

For oxygen and helium service, Series R1924, chemically pure, and with Marpak-Teflon packing system.

Write for detailed information

The standard series is shown opposite.



10 REASONS WHY YOU SHOULD USE NORDBERG *POWER-CHIEF*® OIL FIELD ENGINES

Throughout the oilfields, Nordberg Power Chief Gas engines are consistently compiling records for reliability and low maintenance costs . . . records that in many cases show more than 40,000 hours of continuous operation with original rings, valves, liners, bearings, piston and crankshaft still in place.

Listed at the right are 10 of the reasons behind the outstanding performance of Power Chief Gas engines in 'round-the-clock oilfield service. For the *complete* story, send for your copy of the all-new Bulletin 268 illustrated above.

1. CONSERVATIVE RATINGS
2. OPERATE ON SOUR GAS
3. SMOOTH, STEADY OPERATION
4. WEATHERPROOF
5. SAFEST ENGINE IN THE FIELD
6. EASY STARTING
7. MORE "EXTRAS" AS STANDARD EQUIPMENT
8. EASY TO SERVICE
9. PARTS AND SERVICE READILY AVAILABLE
10. QUALITY CONSTRUCTION THROUGHOUT

NORDBERG MFG. CO., Milwaukee, Wisconsin

NORDBERG
POWER CHIEF
DIESEL and GAS ENGINES

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BRANCHES: Houston, Odessa, Olney
SALES & SERVICE: Casper, Wyo.; Corpus Christi, Longview & Wichita Falls, Texas; Lafayette, La.; Wichita, Kansas.

IN-MAR CO., Wilmington, California

STEPHENS OIL FIELD REPAIR, Fairfield, Illinois

MEAD ENGINE & WELDING WORKS, Sterling, Kansas

CORNELISON ENGINE MAINTENANCE CO., INC.
Seminole, Oklahoma

ROGERS DIESEL ENGINEERING CO., New Orleans, La.

Sheffield products go to sea . . . in the oil industry's offshore treasure hunt. Sheffield supplies many kinds of steel used in building the sea-going drilling platforms — man made "islands" that operate as far as 50 miles at sea.

Sheffield Steel Products Partner in Oil Industry Progress

SHEFFIELD
ARMCO

Steel for the Oil Industry

Wherever oil flows, steel goes. Steel is the master metal in field machinery and drilling rigs. In refinery equipment and pipeline arteries. In tanks and tankers. Can you imagine the fantastic progress of the oil industry without steel?

When you buy gasoline or oil (or any other petroleum product), chances are Sheffield steel played a part in getting it to you. For Sheffield is a major supplier of steel used by the oil industry.

Sheffield's three steel making mills are strategically located in the heart of the oil country. They make a widely diversified line of semi-finished and finished steel products for manufacturers and suppliers to the petroleum industry. Some of these Sheffield steel products: alloy and carbon steel billets, beams, plates and rods. Tankheads and hot-rolled merchant shapes. Bolts, skelp, wire products in big variety.

SHEFFIELD DIVISION ARMCO STEEL CORPORATION SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA

One of a series.

An Inside Peek at Steam Trap Capacity Ratings

or... how to be sure steam heated equipment is going to work the way it's engineered

WHEN YOU GET all through engineering a steam heated process equipment installation, its performance will depend on whether your steam traps will do what the catalog said.

Now, in theory, if you know the size of a steam trap orifice, you can figure how much water can be pushed through it in a given time by a given steam pressure. But, in practice, this doesn't work out. The picture is scrambled by things like the choking effect of flash steam and restriction of flow through the trap and piping.

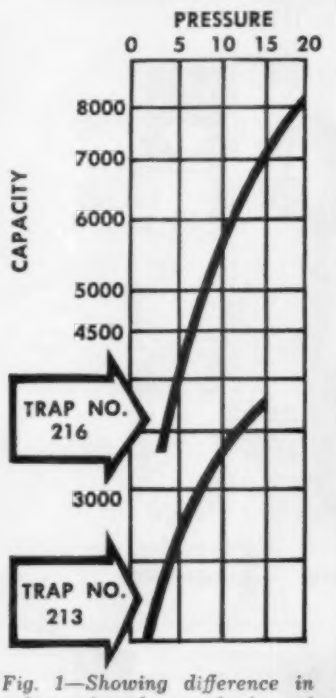


Fig. 1—Showing difference in volume of condensate discharged by a No. 216 trap with 2" pipe connections and a No. 213 trap with ¾" pipe connections—each trap having ½" discharge orifice.

For example, Fig. 1 shows that a ½" orifice in a 125 psi No. 216 Armstrong steam trap with 2" pipe connections will discharge 7200 lb/hr condensate at 15 psi inlet pressure. Yet, a ½" orifice in a 15 psi No. 213 trap with ¾" pipe connections, discharges but 3900 lb/hr at 15 psi inlet pressure. The difference: pipe friction.

Thus, we see a need for investigating the basis for steam trap capacity ratings. Unfortunately, they are not all arrived at in the same way. If they are based on cold water tests, producing no flash steam, they are much too high. Orifice tests are also too high because they ignore pipe friction. Calculations involving flow-through-orifice formulae have never been known to be conservative insofar as traps are concerned.

Armstrong Ratings

Armstrong trap capacity ratings are based on actual operating conditions, determined by hundreds of tests. In these tests condensate at the steam temperature corresponding to test pressure was used. Restriction of flow caused by the choking effect of flash steam, as well as the back pressure created by flash steam and condensate, automatically were taken into account. Actual installation hookups were used, so that pipe friction in both inlet and discharge lines also was reflected in the results.

All this effort assures you the nice, comfortable feeling that comes from knowing a trap will deliver on the job the full capacity claimed in the catalog.

* * *

There is one more ingredient that needs to be tossed into the trap-sizing pot. This morsel is the safety factor—the required excess of trap capacity over calculated condensate load. It will be the subject of the next advertisement in this series. But, in the meantime, if you'd like to get the lowdown, ask for a copy of the 44-page Armstrong Steam Trap Book. It is a complete guide to good trapping practice. It covers not only safety factors, but calculation of condensate loads and trap selection, installation, troubleshooting and maintenance. Just call your local Armstrong Factory Representative, or write: **Armstrong Machine Works, 888 Maple St., Three Rivers, Michigan.**

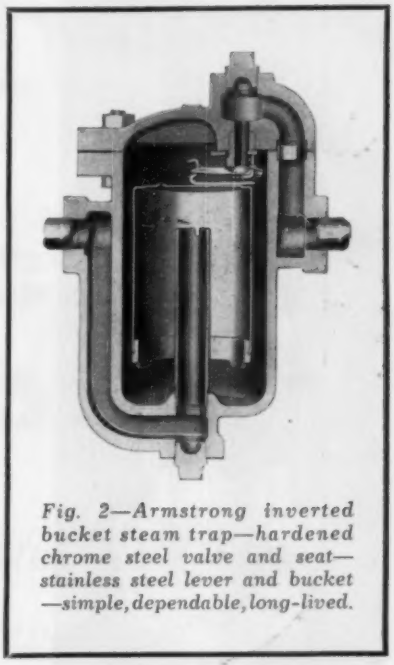


Fig. 2—Armstrong inverted bucket steam trap—hardened chrome steel valve and seat—stainless steel lever and bucket—simple, dependable, long-lived.

ARMSTRONG STEAM TRAPS

You're the Doctor

...when you run casing with

RECTOR TYPE "O"

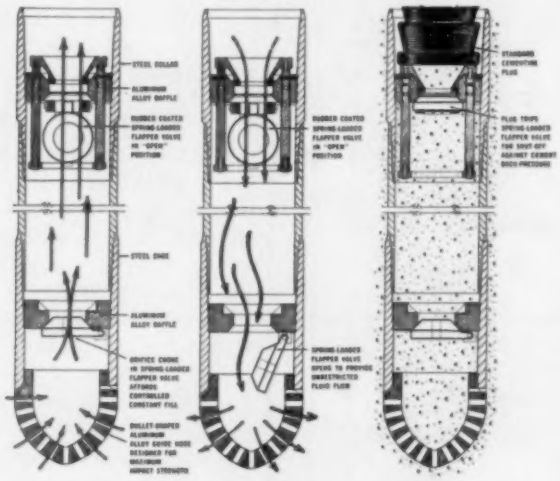
Optional Circulating
FILL SHOE and COLLAR

Rector Type "O" is the ONLY automatic casing fill-up equipment that permits circulating the well at your option, and then continuing to run pipe with controlled fill from the bottom. In cementing the well you use standard heads and plugs. The Type "O" collar provides positive shut-off against back-pressure.

If you need to convert from filling to floating, you can do so quickly by dropping in valve-trip ball at the surface and applying pump pressure.

Type "O" Fill Collars and Fill Shoes, used in combination, are priced competitively with other types of fill-up equipment which do not offer the Rector advantages of optional circulating, protective screening nose, and FULLY DRILLABLE ALUMINUM ALLOY all-metal construction. Prompt delivery through your favorite supply store in O.D. casing sizes from 4½" to 13⅜".

- Controlled casing fill from the bottom with option of circulating and then resume filling.
- Automatic fill-up speeds running time... reduces pressure surges ...protects the formation.
- Spring-loaded flapper valve, with orifice choke, in the baffle assures controlled constant fill.
- Reduces possibility of pipe sticking.
- Converts to float at operator's option.
- Screening nose protects fill equipment from fouling.



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TWO YEAR REPORT

on

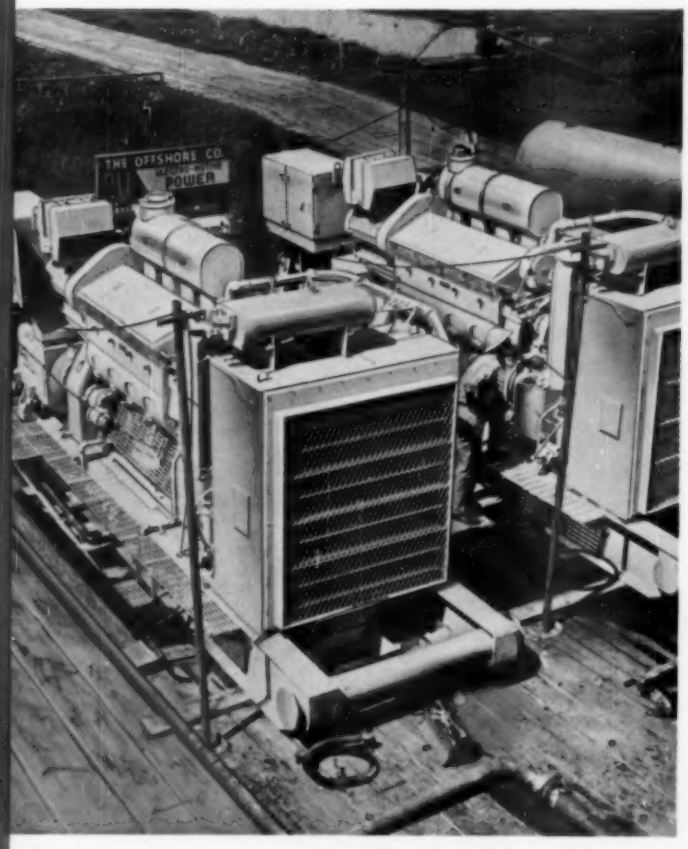
DIESEL-ELECTRIC DRILLING POWER

—a round-up of significant installations of Electro-Motive Power

First integrated Diesel-electric drilling system was installed on a rig of The Offshore Company at Houma, La.

Electro-Motive was the first to offer, through the use of standard production components, a practical Diesel-electric system of resonable cost —designed, built and backed by *one* manufacturer.

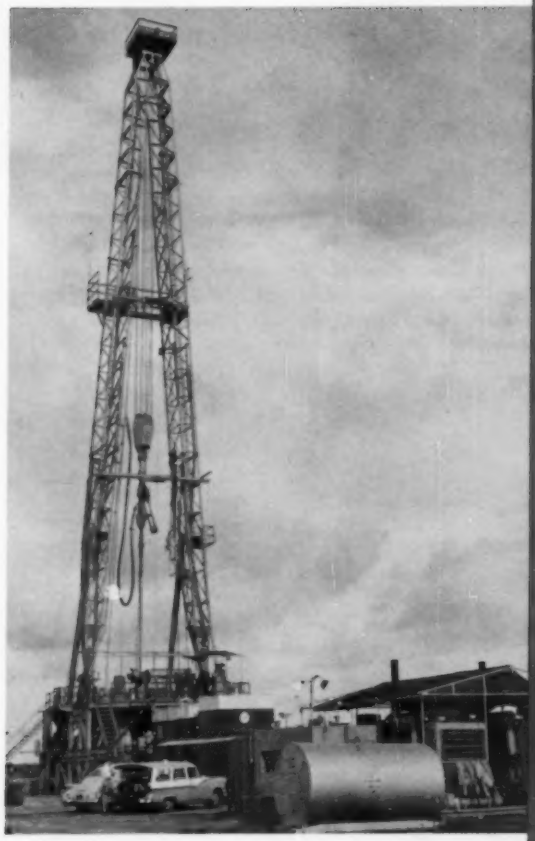
First installation of Electro-Motive Power was in April, 1955, on this rig of The Offshore Company near Houma, Louisiana. Rig later drilled two holes over 10,000 feet before being installed on an offshore barge.



Two 8-cylinder, 875 hp engines driving two 500-kw generators each supplied power to the 625 hp drive motors on draw works, rotary and mud pumps. Engine-generator sets and drive motors were later installed on the now famous mobile platform No. 55 of The Offshore Company.

Today, Diesel-electric is the established power for deep well drilling

—and nowhere are the advantages of this power more clearly illustrated than on these pioneer installations of ELECTRO-MOTIVE POWER



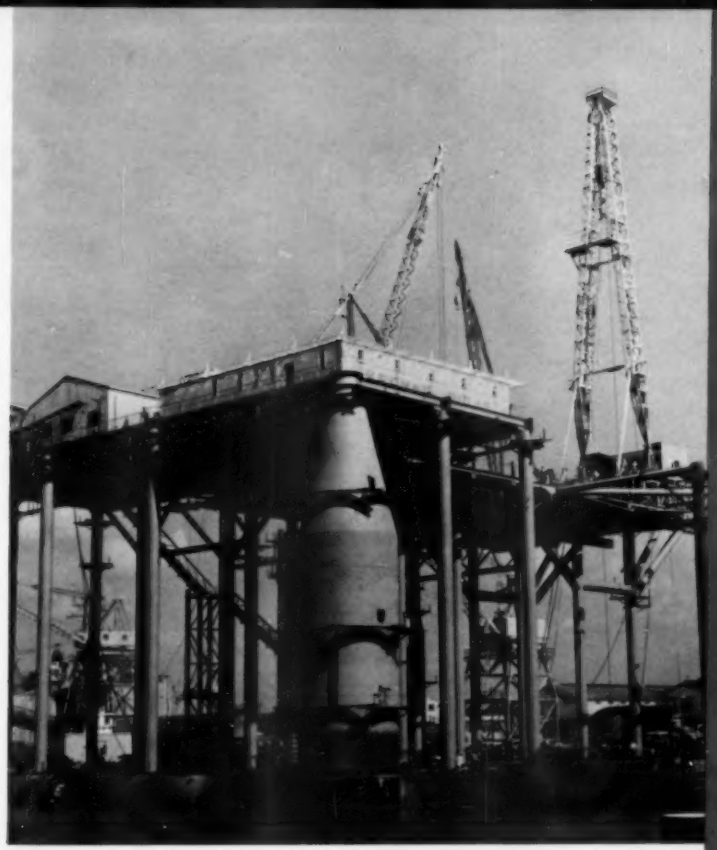
Sun Oil Company rig, capitalizing on the flexibility of connecting power cables, has the draw works mounted beneath the drilling floor. This design avoids clutter, saves space and makes the big rig easier and more economical to move. This was the first major land rig to use Electro-Motive Power.

Kermac Rig 48 was the first complete Diesel-electric tender-platform device to go into service in the Gulf of Mexico. Unit has two Electro-Motive generating sets on the tender, one on the platform. Under emergency conditions, either tender or platform can operate independently. Put into service in June of 1956, this unit has averaged more than 14,000 feet per hole.

Phillips Petroleum Company was the first to utilize Electro-Motive Power on an offshore rig. This rig made its first hole 35 miles out in the Gulf of Mexico. It has been in operation since July, 1955, and has averaged more than 12,000 feet per hole. Two Electro-Motive generating sets supply power to drive motors on draw works, rotary and mud pumps.

Shell Oil Company's Rig 11 is one of the most powerful rigs anywhere. This unit uses three Electro-Motive 875 hp generating sets to drive nine 625 hp drive motors. Mast on this rig is 147 feet. In spite of size, rig breaks into skid-mounted packages for easy transport and fast rig-up.

Big Chief's Rig 34 was put into service in April, 1956. The first offshore platform for this company is an example of how Diesel-electric cuts high-cost deck space. Platform measures only 88 by 145 feet, yet can drill six wells from one location. Electro-Motive Power, with the flexibility of power cables, permitted a space-saving, three-story design.



Kermac Rig 46 was a revolution in mobile units. Launched in October, 1956, this rig has worked on several locations in the Gulf. A sister rig, No. 47, was launched in January, 1957. The unique design of these submersibles imparts extreme stability. Both weathered recent hurricanes without damage. Each contains three Electro-Motive 900 hp generating sets.

Grey-Wolf Drilling Company converted an old steam rig to Diesel-electric with Electro-Motive Power. In so doing, they cut rig-up time almost fifty per cent. Two engine generator sets supply power to drive motors on mud pumps, mud mix pumps and draw works. Rotary is driven by draw works. Unique power arrangement permits operation on one engine. Other engine is used for supplementary and standby power.

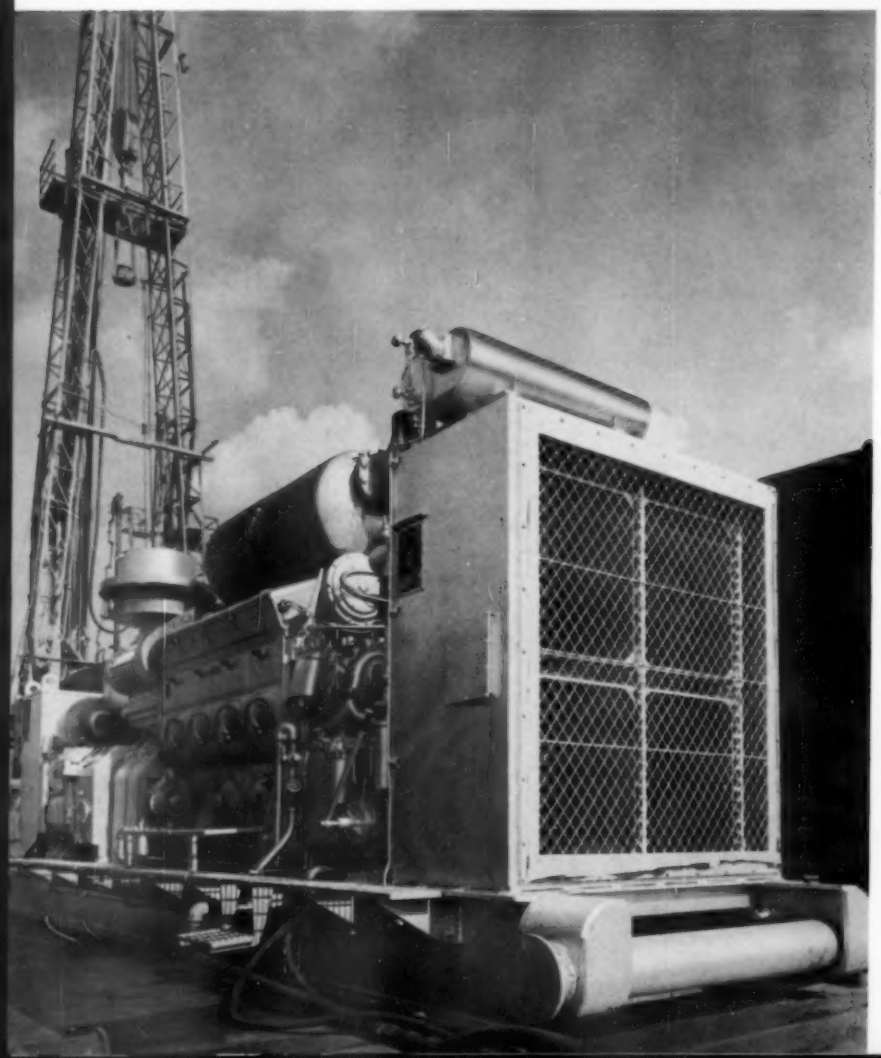
Penrod Drilling Company launched two Diesel-electric barges in 1956, the Bill Dordan and Tom Sorrell. These were the first shallow water barges to apply Electro-Motive Power. Each is fitted with three engine-generator sets with heat exchanger cooling. Both are capable of drilling 18,000 feet in 19 feet of water.

And this is the new ELECTRO-MOTIVE

—the first standardized, completely self-sufficient Diesel-electric drilling power system

The SR-10 is a refinement of Electro-Motive's original plan to offer the drilling industry a completely integrated Diesel-electric power system—*designed, manufactured and backed by one company.*

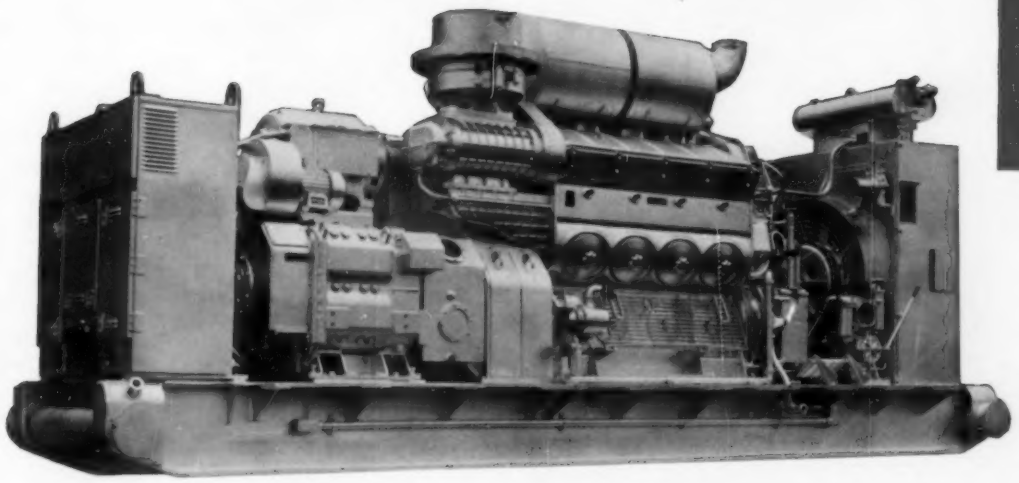
The new power plant brings to deep well drilling the added power and control needed to match the oil industry's increasing need to drill deeper, faster and more economically.



The SR-10 is shown here being field tested on Sun Oil Company's Rig 15 at Rayne, Louisiana.

Diesel-electric

SR-10 POWER UNIT



Integral AC Supply

A new integral AC generator (100-kw) makes the SR-10 completely independent of outside AC supply for blowers, excitation and control equipment.

Increased Power

Engine horsepower has been increased to 1000. New D-49G generators produce up to 640-kw each (two per engine). New D-49M drive motors deliver up to 800 horsepower.

Greater Power Utilization

New load regulator provides load balance between units. Thus, if power requirements exceed that available on one unit, the load regulator automatically loads a second unit to satisfy drilling demands.

Reduced Maintenance

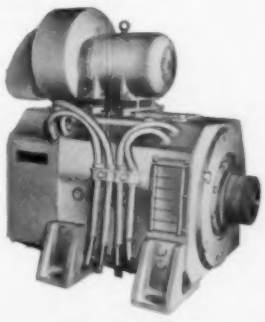
New improved motor control cabinet is simpler and more efficient. Its new design combines with many other improvements, both mechanical and electrical, to make the SR-10 easier to operate and maintain.

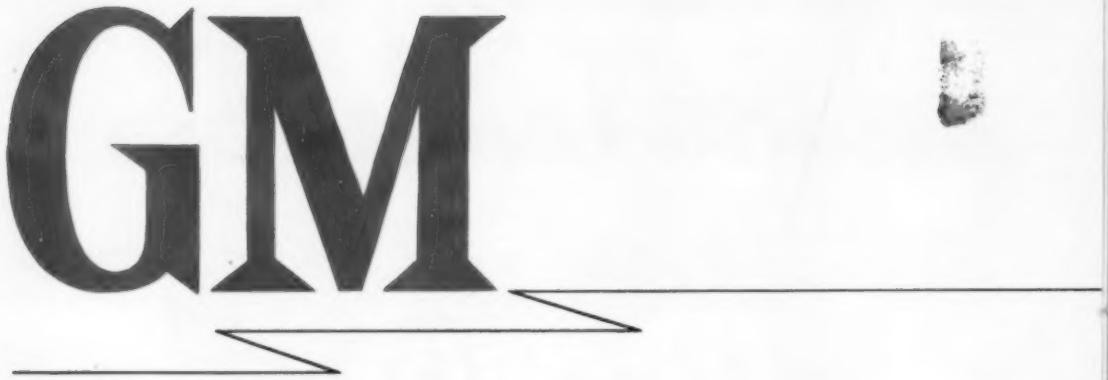
Lighter Weight

A new speed-increasing transmission between the engine and generators and other changes have cut the weight of the air cooled unit by more than 2000 pounds.

NEW D-49M DRIVE MOTOR

Improvements in design and materials of both the new motor and generator permit increased horsepower and provide better moisture protection. Motors and generators are identical except for field windings, a factor that facilitates service and reduces costs.





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ELECTRO-MOTIVE DIVISION
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LA GRANGE, ILLINOIS

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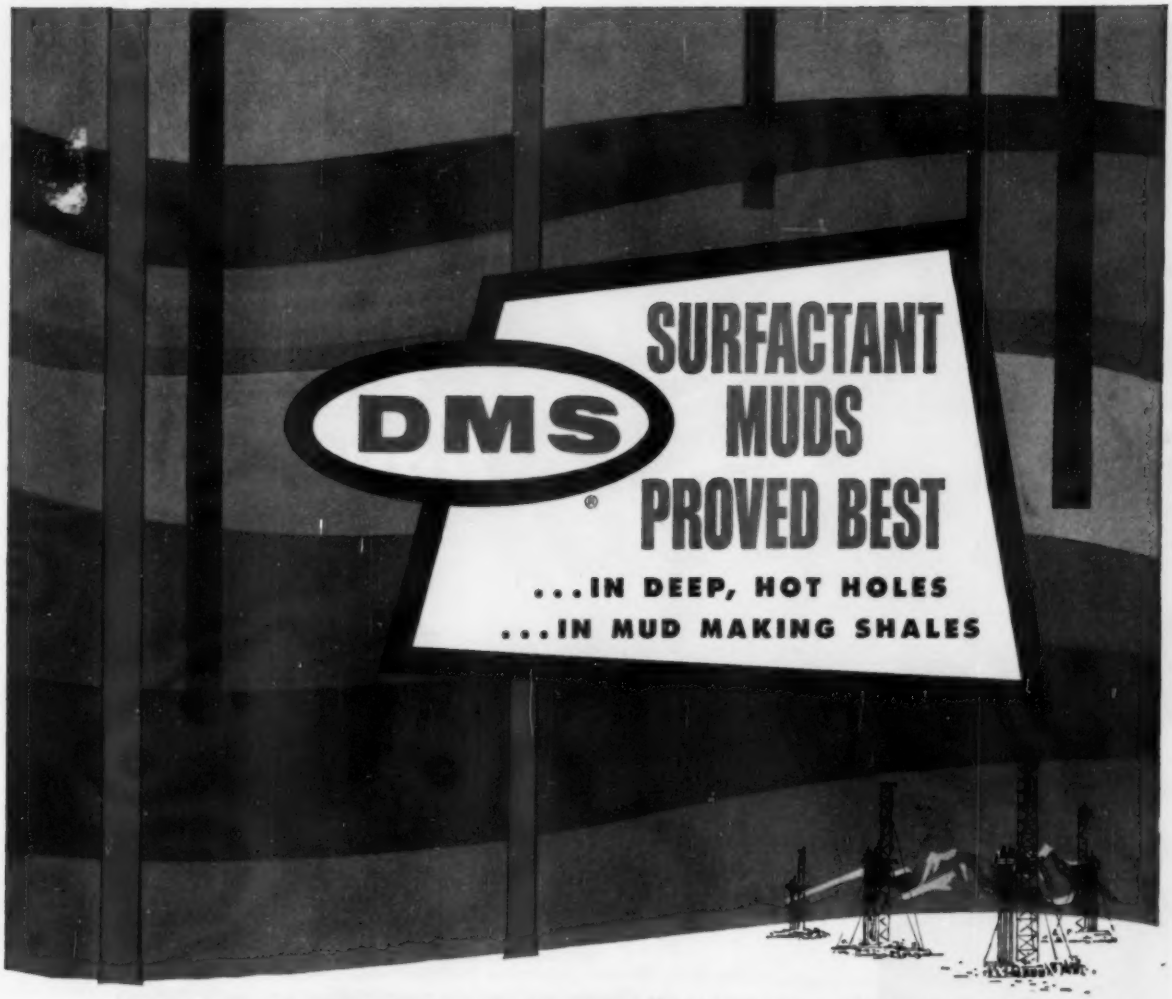
Houston, Texas, 1222 Texas National Bank Building, Phone FAirfax 3-3437

Morgan City, Louisiana, 1112 Offshore Oil Center Building, Phone: Morgan City 4411

Los Angeles, California, 5928 So. Malt Ave., Phone: RAymond 3-6247



NO HIGH TEMPERATURE CEMENTATION, LOW CONDITIONING TIME, LOW VISCOSITIES AT HIGH SOLIDS CONCENTRATIONS, GOOD COMPLETION MUD

DMS the primary surfactant, & DME the companion surfactant for oil emulsification

DMS and DME have a reputation in the field for fast, trouble-free deep well-drilling. This is particularly true in mud-making shale formations, and when high temperatures are encountered. DMS inhibits dispersion of drilled clays and shales, and protects producing formations and drilled solids from swelling. Drilled solids are larger and settle in pits faster, resulting in easier maintenance and less barite consumption.

Because of their stability in the presence of different electrolytes, DMS and DME have been used successfully in calcium, sea water, and saturated salt muds. The surfactant additives are not adversely affected by drilled anhydrite and salt.

Overall cost of drilling is reduced by decreased consumption of barite, less mud conditioning time, good formation protection and completion characteristics. This results in faster drilling with more time on bottom and less rig time to completion.

DMS and DME are available in your area from MILWHITE MUD SALES CO. Write direct to MILWHITE using coupon below for complete technical information, giving a description and use information on DMS and DME.

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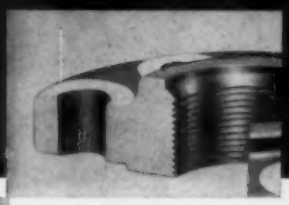
PHOENIX FLANGES

You can't buy a better flange...



Forged Steel. Shot Blasted. All Phoenix flanges meet full A.S.A. specifications — carbon steel and alloy.

Spot faced bolting surfaces, extra fine facings, accurate threading and a protective coating are typical of Phoenix quality.

Precisely machined welding bevel.

Special facings, bores, drilling, threading and special machining available.

The long life and precision workmanship you have a right to expect in the flanges you buy are assured when you order Phoenix forged steel flanges. You simply can't buy a better flange! It costs no more for Phoenix quality and *service*. That's why it's always worthwhile discussing your pipe flange requirements with the Phoenix representative.

A serrated gasket surface finish is standard on all Phoenix flanges with raised facings.

Write for handy 36 page pocket-size reference booklet containing useful data on flanges. It's FREE!

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FLANGE AND FORGING DIVISION

PHOENIX MANUFACTURING COMPANY

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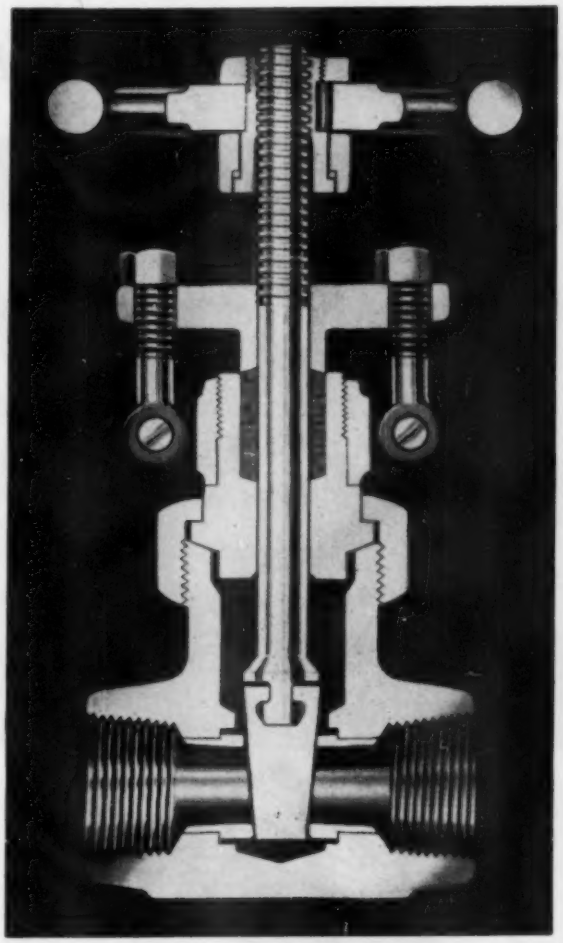


The Feeling is
MUTUAL

CHAPMAN LIST 960
Forged Steel Gate Valves

You want small steel valves that give the best performance and cost the least for maintenance. Chapman thinks the same way and does everything possible to give you what you want.

On Chapman List 960 Forged Steel Gate Valves the wedge faces are *super* hard. They're hardened to 800 Brinell by Chapman's exclusive Malcomizing process. They can't seize. They can't gall. They're built for rugged service.

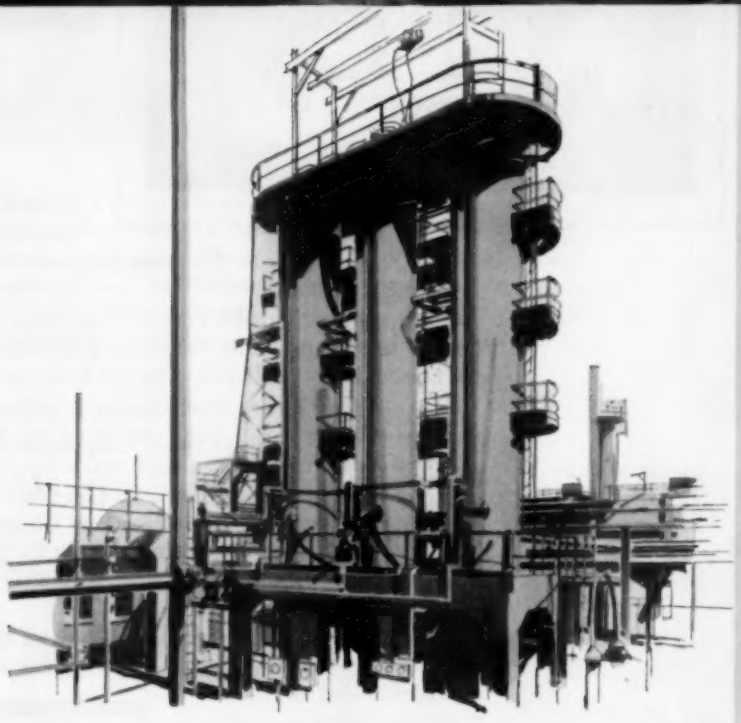
Even the long lasting seat rings are hardened stainless steel and are very easy to replace when necessary. Also, you have no full-pressure repacking difficulties with Chapman List 960 valves.

Today, there are more Chapman List 960 valves on more jobs than any other small forged steel gate valve. Valve men and Chapman see eye to eye on performance and costs. List 960's come in sizes from ¼″ to 2″. They stand up perfectly under conditions from 380 psi at 1000°F. to 2000 psi at 100°F. Of course, for higher pressures you use Chapman List 990 valves.

With the 960's you can order Bonnet joint either gasketed or ground metal-to-metal. You can have rising stem with yoke or rising stem with inside screw. You find them all in our Catalog 10. Write today for a copy.

The CHAPMAN
Valve Manufacturing Co.
INDIAN ORCHARD, MASSACHUSETTS

The idea that works best for you



More Than Forty Years Of Leadership In Petroleum Refining Technology

has meant a lot of work for us

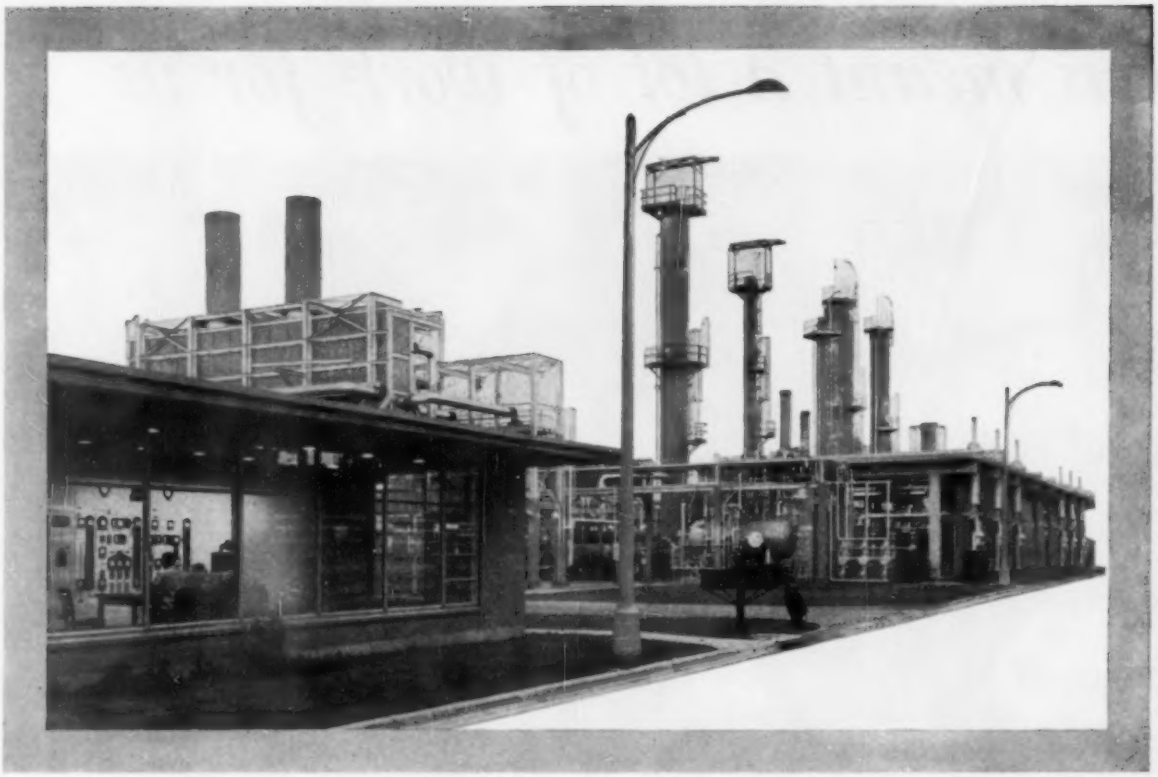
We should know. For more than 40 years UOP has been developing ideas to improve petroleum refining technology. In that time we've had a whale of a lot of ideas. Very few of the successful ones come easy. Most have to be developed the hard way, through months, even years, of creating, trying, perfecting and proving. And the pay-off for our staff of scientists, technicians and engineers comes with the proving, when the idea has been perfected so that it can work well for you.

Once we're sure it is a practical, workable idea that will help make oil refining more efficient, more productive, more profitable, it doesn't go into limbo or on the shelf. It is made immediately available to all refiners regardless of the size or scope of their operation, anywhere in the free world. We think our obligation to the industry can only be fully answered through this policy —create the ideas, make them workable and put them right to work for the benefit of everyone.

UOP

UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U. S. A.



Electronic Control SAVES THOUSANDS OF DOLLARS even before start-up

Here is how: The installation of 'American-Microsen' Electronic Controls eliminated the need for a new control house when a new platformer unit was erected at the Pontiac Refining Corporation in Corpus Christi, Texas.

The existing control house (shown above) is far from the site of the new unit. Transmission distances up to 800 feet were involved—distances too great for conventional process instrumentation. But 'American-Microsen' Electronic Instruments are completely unaffected by distances up to 30 miles. Accurate dc signals are transmitted over simple 2-wire circuits with split-second speed. Consequently, Pontiac found it both practicable and economical to install the new platformer instrument panel right in the existing control house.

In addition, transistors, printed circuits and miniaturized components provide the ultimate in reliability, service life and space-saving simplicity. These are but a few of many reasons why 'American-Microsen' – the all-electronic system that uses only three units – is widely preferred for measurement, transmission and control. Write for literature and ask that a sales engineer from our nearby district office call and explain fully. No obligation, of course.

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MAKERS OF 'AMERICAN-MICROSEN' ELECTRONIC INSTRUMENTS FOR MEASUREMENT, TRANSMISSION AND CONTROL

This man knows his salt in sweetening problems

(Dow technician's background of experience aids ethanolamine users)

It's true that no one can be right all the time. Because of this fact, your Dow tech service man never stands alone in solving sweetening or dehydration problems.

The conclusions he offers climax a team effort in the lab or are wrestled from an accumulation of data on ethanolamines and glycols as used by gas processors in all parts of the world. Processors' problems and proved solutions are a matter of Dow record which our tech service men refer to constantly. Representing such a backlog of experience and by combining lab talents, these men are hard to stick on a gas processing problem. Often you need only to mention the difficulty.

Corrosion in a sweetening or glycol dehydration unit? Whether the cause is salt in a dehydration unit or contamination in a sweetening unit, your Dow tech service man may have the answer (based on many hours' work of many people) in minutes. It could be in the return mail! THE DOW CHEMICAL COMPANY, Midland Michigan, Dept. GD 818H-2.

YOU CAN DEPEND ON DOW

Step in... NEW '58

NEW TILT CAB TRUCKS . . . lowest-priced* Tilt Cab line in America! Six new series, up to 60,000-lb. GCW, are typical of the wide choice in Ford's heavy duty line.

*Based on a comparison of manufacturers' suggested retail prices

(Background) **NEW TWO-TON** stake with your choice of Short Stroke Six or V-8's.

NEW '58 FORD PICKUP. Modern Styleside body is as wide as the cab and *standard at no extra cost!*

Step ahead... with all

Meet America's newest, most modern trucks—Ford for '58! Discover the new advances in this pace-setting line. See the important advantages that help you do your job better and at lower cost!

Then match your specific requirements against Ford's over 300 new models. Whatever your need—from half-ton pickup to heavy duty tandem—Ford's got it! And *you'll* get a truck that costs you less to own, less to run and lasts longer, too.

So see your Ford Dealer today and step ahead with America's most modern truck—built modern to cost you less.

NEW CAPACITY! Extra-wide Styleside pickup bodies have up to 41% more loadspace than others . . . *biggest loadspace per dollar!*

NEW SAVINGS! Only Ford offers this modern, extra-capacity pickup body *at no extra cost!*

NEW EASY RIDE! Scientific Impact-O-Graph ride tests prove amazing superiority of Ford over competitive pickups—a ride mighty close to that of a car!

NEW POWER! More powerful, more rugged V-8 engines! And only Ford offers Short Stroke economy in *both* Six and V-8!

'58 FORD TRUCKS—FIRST WITH THE FEATURES THAT COUNT!

FORD TRUCKS

that's new...costs less, too!

NEW SAFETY! "Safety Vision" dual headlights . . . Lifeguard steering wheel . . . double-grip door locks, standard equipment on Ford trucks!

NEW "FINE CAR" CONVENIENCES! Ranchero offers all power assists, including power windows. You can even get factory-installed air conditioning at Ford's low prices.

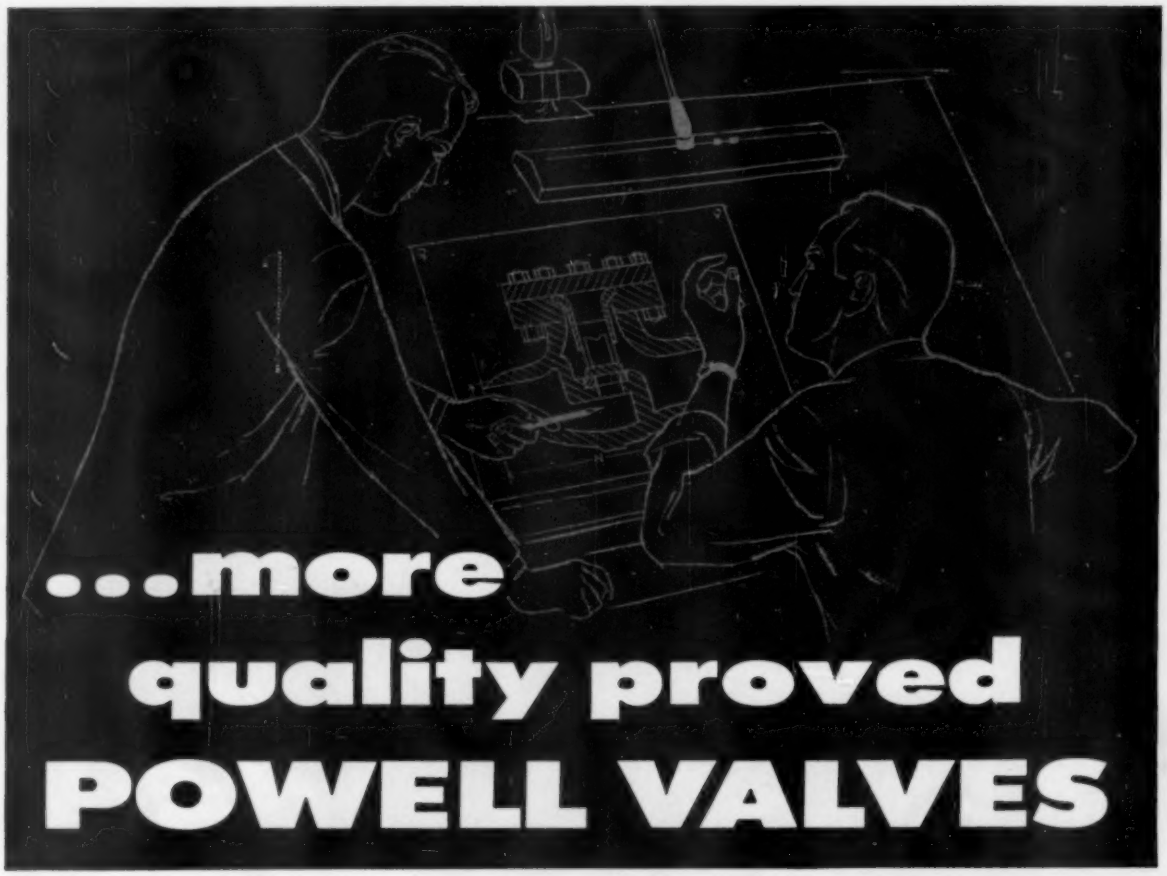
NEW COMFORT! Only Ford truck Driverized Cabs have this comfort combination: woven plastic upholstery, non-sag seat springing, suspended pedals and weather-protected inboard steps.

NEW TILT CAB SAVING! Hundreds of dollars less than other Tilt Cabs . . . America's lowest-priced* Tilt Cab line.

The big fleets buy more Ford Trucks than any other make!

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . LAST LONGER, TOO!



...more quality proved POWELL VALVES

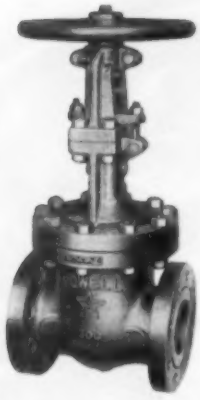


FIG. 3003—Steel Gate Valve for 300 Pounds W.S.P.

FIG. 1559—Steel Lubricated Plug Valve, ASA 150 Pounds, Screwed Gland Type, 1" to 4", inclusive.

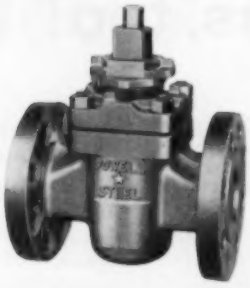


FIG. 2456 SG—Large Stainless Steel Gate Valve for 150 Pounds W.P. Flanges conform to latest Standards.

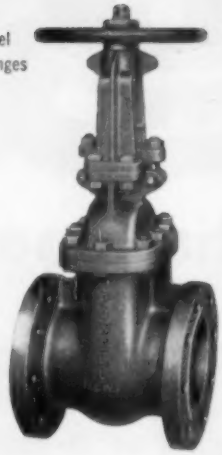
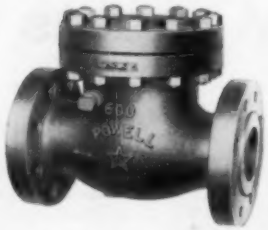


FIG. 6061—600-Pound Steel Swing Check Valve.

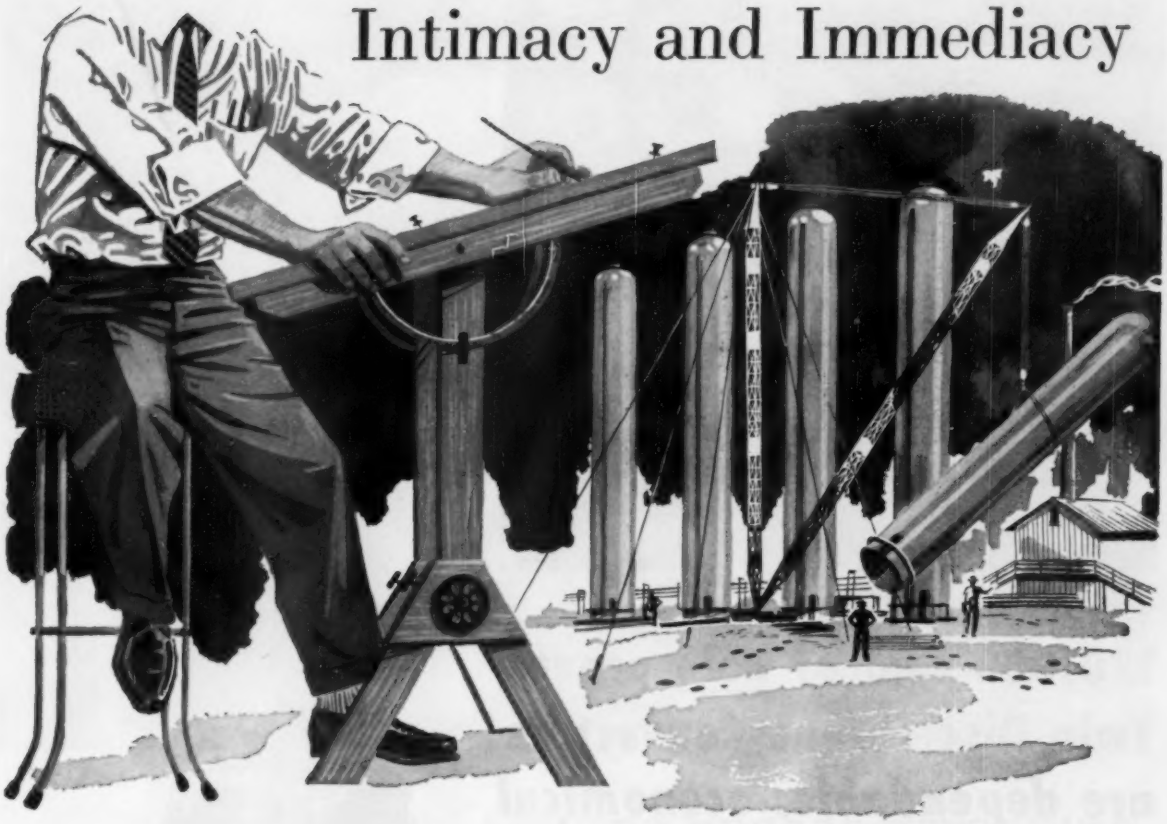


Designed for long life, designed for dependable service

Consult your Powell Valve distributor for all the facts about quality proved bronze, iron, steel and corrosion-resistant valves. No matter what the flow control problem, a Powell Valve can solve it . . . *better.*

THE WM. POWELL COMPANY, CINCINNATI 22, OHIO . . . 111th YEAR

Intimacy and Immediacy



YOU GET BOTH IN A PRITCHARD SINGLE RESPONSIBILITY CONTRACT

Two prerequisites to a successful construction project—whether it be for a new plant, modernization or expansion of present petroleum and gas facilities—are an intimate knowledge of the project, and the ability to hasten its completion.

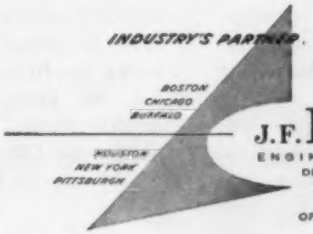
With a Pritchard Single Responsibility Contract you are working with only one firm. Complete responsibility for everything is solely with Pritchard. Since no other prime contractors are involved, Pritchard is intimately familiar with what is going on and can accurately report progress to you. Designers work closely with engineers; engineers coordinate drawings with actual construction, and purchasing is done on a precise time schedule.

How about immediacy? From the moment you sign your Pritchard Single Responsibility Contract there is a steady flow of activity. No time is lost. Preliminary construction begins even before final engineering drawings are completed. Materials arrive on the job site to coincide with strict timetables. The result? Your project is completed faster, your new plant is in operation producing income sooner and you can free invested capital faster for other uses.

Before you go any further with your new plant or plant expansion, investigate all the advantages that are yours with a Pritchard Single Responsibility Contract.

YOUR INQUIRY IS INVITED

SERVING THE GAS, PETROLEUM, CHEMICAL, PETROCHEMICAL, PULP, AND PAPER INDUSTRIES AND THE POWER PLANT NEEDS OF INDUSTRY AND CORPORATE UTILITIES.



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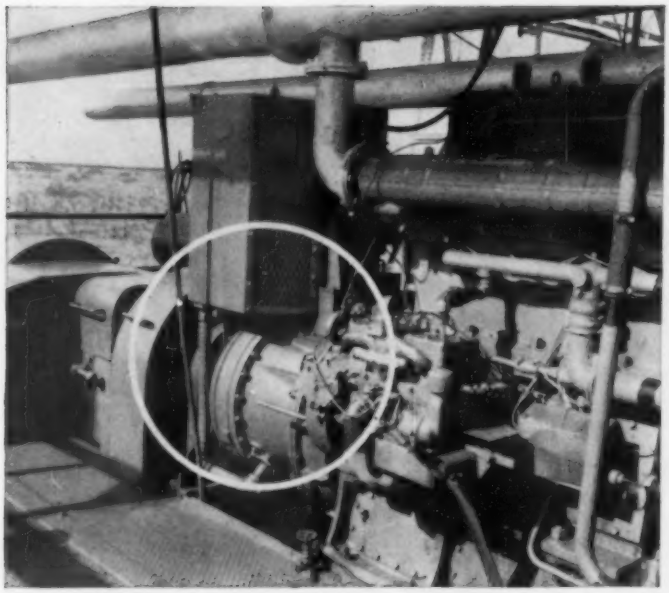
OF COOLING TOWERS AND GAS AND AIR TREATING EQUIPMENT



Circle *(far left)* points out a Twin Disc Torque Converter on one of the Waukesha Engines, powering this Ideal Model 80 Lowe Drilling Co. Drawworks.

120,000 feet of hole prove Twin Disc Torque Converters are *dependable, economical*

With four years and 120,000 feet of hole behind them, two Twin Disc Torque Converters—owned by Lowe Drilling Company of Midland, Texas—are still in tip-top shape. The *only* service necessary was the replacement of an oil pump.

The torque converters are mounted on two 450-hp Waukesha Model LRZ gas engines, transmitting power to an Ideal Model 80 Drawworks.

In addition to their *durability and dependability,* the torque converters deliver *more power* by allowing the engines to operate within maximum power range under a wide variation of loads. The exact speed ratio required is *automatically* selected for every operation.

Through *fluid* connection, the Twin Disc Torque Converters cushion *out* harmful shocks and vibrations—thus *increasing* machinery life, *reducing* engine wear and *minimizing* costly downtime.

Twin Disc has a complete line of torque converters, both single-stage and three-stage, for every horsepower range from 30 to 1000—offering a wide variety of capacities and a broad range of input, output combinations.

Take advantage of the many cost-cutting, profit-making features of Twin Disc Torque Converters. For complete details, contact the Twin Disc District Office nearest you . . . Tulsa: Enterprise Building, Sixth and Boston, GIbson 7-1578. Dallas: 1511 Turtle Creek Boulevard, RIverside 3014. Los Angeles: 2950 Leonis Boulevard, LOgan 8-3309.

TWIN DISC

TWIN DISC

Torque Converters

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

BRANCHES OR SALES ENGINEERING OFFICES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • TULSA

Mechanized Cutting Speeds Scrapping of 95-Ton Pressure Vessels

Scrapping huge pressure vessels loomed as a costly, time-consuming job for a large scrapyard in Birmingham, Alabama. But mechanized oxygen-cutting quickly cut this job down to size—and with substantial savings in labor and materials.

The versatile OXWELD CM-45 Portable Cutting Machine teamed up with a C-56 Blowpipe to slice through 8-in. thick laminated steel walls at a speed of 4 to 5 in. per minute. Two 24-ft. cuts were made in each vessel in less than two hours' time. Transverse cuts were then made to reduce these sections to charging-box size.

Today scrapyards, fabricators, and maintenance shops everywhere are slashing costs with the speed and efficiency of mechanized oxygen-cutting.

See how you, too, can save. Ask your nearby LINDE representative to show you the *complete* line of dependable OXWELD Portable Cutting Machines—or write for free catalog F-4487. Do it today!

LINDE COMPANY

DIVISION OF UNION CARBIDE CORPORATION

30 East 42nd Street, New York 17, N. Y.

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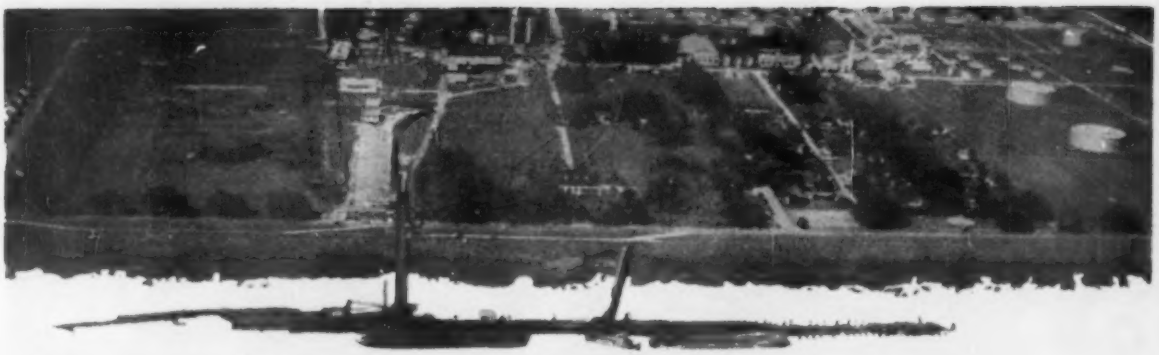


W. HORACE WILLIAMS CO., INC.

DOES IT AGAIN!

An oil company suffered the loss by fire of 630 feet of loading wharf. It was discovered that the lower portions of piles were still sound. A unique design of steel frames, supported by sound portion of piles, was employed. A concrete deck was poured over the steel frames. This resulted in a considerable saving and at the same time gave the resultant structure a fire-resisting construction. W. Horace Williams Co., Inc. engineering skill and know how saved this company considerable money!

Scene at left shows the river with the reconstructed fire-damaged portion of wharf. Notice the steel frames above old piles and the concrete deck.

ENGINEERS
W. HORACE WILLIAMS COMPANY
INCORPORATED
GENERAL CONTRACTORS

833 Howard Ave. Ph. RAymond 1291

Marine Contractors Since 1908
NEW ORLEANS

OFFSHORE STRUCTURES, WHARVES, BULKHEADS, FOUNDATIONS

They Say—

Texas, Okla. both wrong?

Dear Sir:

Your editorial of October 21, (p. 63) points up the interesting question as to whether Texas or Oklahoma philosophy is correct as to curtailing production to buyer nominations.

If, as a state reduces its allowable, importers take up the slack, when will it be time to stop reducing allowables? I realize Oklahoma's approach is no solution, but have you pointed to a solution? It seems that all you have done is to point up a problem.

Emby Kaye
Tulsa, Okla.

Journal boosts drillers

Dear Sir:

Throughout the entire year I have served as president of the American Association of Oilwell Drilling Contractors The Oil and Gas Journal has been very generous with our industry.

It is no secret our business has been down considerably and your editorial policy has helped keep it from being considerably worse so far as individual contractors are concerned.

Finally, the paper, "Forecast of Activity in the Drilling Industry," prepared by John C. Casper (Journal economist) helped materially in making our seventeeth annual convention a real success. Undoubtedly this took a great deal of Mr. Casper's time in preparation; all of us in the drilling industry appreciate his and your contribution.

I must admit I have been a little gloomy about the outlook. Mr. Casper's views have helped cheer me.

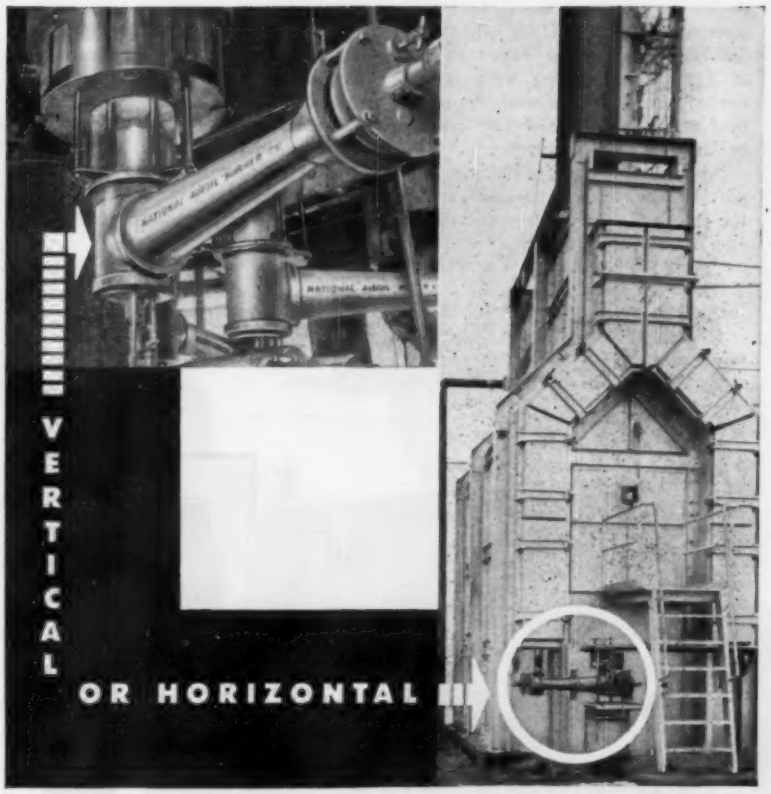
Jack H. Abernathy
President,
A.A.O.D.C.
Oklahoma City.

Socony's stand on imports

Rawleigh Warner, Jr., manager of Socony Oil Co.'s economics department, gave the following answers in an interview appearing in the autumn issue of The Flying Red Horse, Socony's company magazine.

Q. Will cutbacks (in imports) reduce the large inventories of crude oil plaguing the industry right now?

A. I doubt they will make much difference. This inventory situation stemmed largely from other causes. For one thing, surpluses of crude oil



many more hours on stream without forced shutdown with NATIONAL AIROIL

OIL-GAS TANDEM COMBUSTION UNITS

Exclusively for vertical firing, the new National Airoil VERTICAL Tandem Block Units retain all the features of our regular horizontal Tandem Units . . . *plus:* special, pre-cast refractory shapes for easier, cost-saving vertical installation and maintenance; secondary air inlet louvres for positive control of vertical flame pattern; and, all steel duplex detaching gear which enables swift, simple vertical burner changeover.

VERTICAL and HORIZONTAL Tandem Units hold air in the combustion zone until fuel and heated air are thoroughly mixed. This means that ignition takes place in a hot zone; the result: high fuel economy through more rapid combustion with a minimum of excess air. NATIONAL AIROIL's patented Tandem Combustion Units allow secondary air to be easily and accurately controlled. By adjusting air control louvres, flame can be shaped to radiate heat uniformly without tube impingement.

The VERTICAL or HORIZONTAL Tandem Unit is always fired with NATIONAL AIROIL Combination Oil and Gas Burners . . . has a high turndown ratio with a steady flame temperature using either fuel oil or gas. With the TANDEM UNIT'S clean flame, a cold furnace can be brought to full capacity in a short time.

"Many, many more hours on stream, without shutdown" . . . yes, YOU will realize higher profits from YOUR heaters when NATIONAL AIROIL VERTICAL or HORIZONTAL Tandem Units are specified. Our new Bulletin 498 is yours for the asking.

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INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

accumulated in the U. S. when Middle East crude again began to flow to Europe last spring with the reopening of the Suez Canal. An operation as big as the Oil Lift couldn't be shut off like a faucet.

Also, warm weather in the latter part of the winter reduced demand for heating oils below expectations, and bad weather last spring cut down on farm demand and on automobile driving. Imports haven't been a big factor in the inventory pile-up.

Q. The factors you mentioned are temporary ones. Aren't there more basic reasons for the big inventories?

A. Yes. One very important factor is the continuing rapid expansion of natural-gas sales. They have nearly trebled in the past 10 years, and a part of this expansion has come at the expense of oil sales; about three-fourths of the marketed production of natural gas is competitive with oil.

It's a much more important factor than imports.

Last year, natural gas took nearly 35 per cent of the total U. S. market for liquid and gaseous hydrocarbons —the products of the well. Crude-oil imports actually took less than 3½ per cent.

Best you can buy!

SPANG

DRILLING BITS

Die Forged . . . Completely Heat Treated They Drill More Hole for Less Cost

Made in Butler, Pa. . . . used 'round the world . . . SPANG BITS are BEST:

1. DIE-FORGED—gives uniform section from end to end.
2. FULLY HEAT-TREATED—they have maximum grain refinement assuring stronger pin, collars and blade sections.
3. TOUGH BLADE SECTIONS—means maximum penetration in hardest formations.
4. PROPER DESIGNED WATER COURSES—providing better mixing, more room for cuttings and allowing faster drilling.
5. SEMI-DRESSED DRILLING ENDS—bits dress out to gage quicker with fewer heating.
6. SELECT YOUR STEEL—made in high carbon and two grades of alloy steel—select the one best suited for your conditions.

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For over 60 years manufacturers of Spang Weldless Jars and a complete line of Cable System Drilling and Fishing Tools for oil and gas wells, water wells, prospect drilling and shot blast holes.

USE SPANG BITS— THEY ARE BEST for YOUR OPERATION

SEE COMPOSITE CATALOG for ENTIRE LINE!

Somebody goofed!

Dear Sir:

What a bust for a bunch of experts! (see map, OGJ, Oct. 21, p. 72). The San Juan basin is in northwestern New Mexico and southwestern Colorado.

Good magazine despite the busts.

Sherman A. Wengerd
Consulting Geologist
Aubuquerque, N. M.

Radio repairs for engine?

Dear Sir:

I showed your article on "electronic brain" fuel injection in the October 7 issue, of The Oil and Gas Journal, page 108, to several of the office gang and got the comment, "Now if you have engine trouble you won't know whether to go to an engine shop or a radio repair shop."

Let's hope it's better than the TV repairs.

Chet Murray
Bechtel Corp.
San Francisco

Servicing ups supply costs

"Less and less does the tool pusher or the contractor come into the supply store. It is not at all uncommon for a tool pusher to give an order for 10 pounds of rags to a salesman to be delivered that day or the next while he himself may make one or two trips into the town where the store is located the same day.

"The supply man is willing to take this order and in some cases deliver it as far as 50 to 70 miles away because he hopes it will lead to his participating in some of the expensive items you must buy in your operation. There are countless trips made by sales and service people to try to see your representative where no contact is made whatsoever, due to poor planning. . . You do not need to be reminded that as our selling costs increase, the goods you buy cost you more.

"I do not suggest that field service to your rigs should be discontinued. You are entitled to good service because of the amount of money you spend with us to carry on your operations. . . By being conscious of our problem of extravagant servicing, I am convinced there are many trips that your representatives can eliminate on the part of the supply and service man. It seems apparent that a little forethought and better planning in ordering supplies will be helpful in time-saving and delivery costs."

Rainey Elliott, president, Jones & Laughlin Supply Division, at the an-

25 years completed

another quarter-century beginning

There will be no celebration on the day in 1957 when Dowell becomes twenty-five. At each of the 165 Dowell offices and stations in the U. S. and Canada, Dowell crews will be too busy. The moment that passes between twenty-five years of a job well done, and the quarter-century ahead will be unnoticed in the hum of the Allisons, the roar of diesels. These past twenty-five years have witnessed the coming of age of petroleum technology. Dowell is proud to have been a part of this technological revolution. Yet, at Dowell, we realize that our most challenging years lie ahead - - as we continue developing and improving new techniques to increase your oil and gas production. Dowell Incorporated, Tulsa 1, Oklahoma.

Services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

behind every job -

25 *years' experience*

For twenty-five years Dowell men have been going places. They have built the most advanced equipment, including the powerful Allison pumpers. They have developed and are constantly improving the industry's widest assortment of specialized well treating chemicals. They have perfected new and exciting techniques of fracturing, acidizing and cementing. These are important reasons why you have called Dowell. But there's still another: the twenty-five years' experience Dowell men have had throughout the U. S. and Canada. Experience built on doing the job right, doing it safely, doing it so you will continue to call Dowell.
Dowell Incorporated, Tulsa 1, Oklahoma.

25 *years forward*

Services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

nual meeting of American Association of Oilwell Drilling Contractors in Tulsa.

CALENDAR

NOVEMBER

11-14 American Petroleum Institute, thirty-seventh annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

12-14 National Association of Corrosion Engineers, northwest region fall meeting, Penn-Sheraton Hotel, Pittsburgh.

14-15 Canadian Well Logging Society, formation evaluation symposium, Al San Club, Calgary, Alta.

14-16 Magic Plains Oil Exposition, Borger, Tex.

22 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

DECEMBER

1-3 Interstate Oil Compact Commission, annual meeting, Tulsa.

1-3 Kansas Independent Oil and Gas Association, twentieth annual meeting and oil show, Broadview Hotel, Wichita, Kans.

1-6 American Society of Mechanical Engineers, annual meeting, Statler Hotel, New York.

2-6 Twenty-sixth Exposition of Chemical Industries, Coliseum, New York.

8-11 American Institute of Chemical Engineers, annual meeting, Conrad Hilton Hotel, Chicago.

10-11 University of Oklahoma, second annual conference on water quality control for subsurface injection, sponsored by the School of Petroleum Engineering, Extension Study Center, Norman, Okla.

JANUARY

11-12 National Oil Scouts and Landmen's Association, directors' meeting, Adolphus Hotel, Dallas.

16-18 Association of Oilwell Servicing Contractors, second annual convention, Baker Hotel, Dallas.

19-22 Pipe Line Contractors Association, tenth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

31 Natural Gasoline Association of America, regional meeting, Skirvin Hotel, Oklahoma City.

FEBRUARY

12-14 National Association of Corrosion Engineers, Tulsa section, ninth annual corrosion short course for pipeliners, Mayo Hotel, Tulsa.

16-20 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Hotel Statler, New York.

26-28 American Petroleum Institute, Division of Production, southern district meeting, Shamrock-Hilton Hotel, Houston.

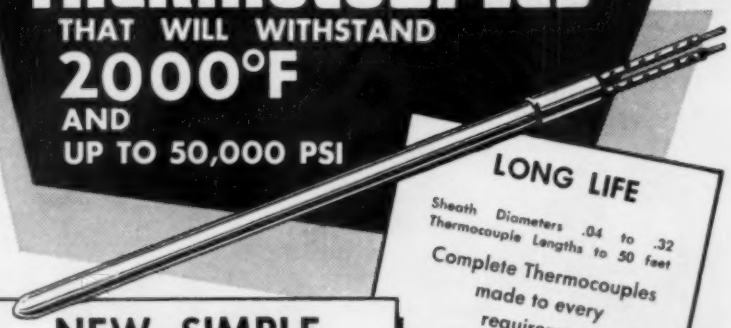
28 Natural Gasoline Association of America, Permian basin regional meeting, Lincoln Hotel, Odessa, Tex.

MARCH

3-4 Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, fourth annual joint meeting of Rocky Mountain petroleum sections, Cosmopolitan Hotel, Denver.

5-6 Gas Conditioning conference, sponsored by the University of Oklahoma, Oklahoma Memorial Union Building, Norman, Okla.

THERMOCOUPLES
THAT WILL WITHSTAND
2000°F
AND
UP TO 50,000 PSI



LONG LIFE
Sheath Diameters .04 to .32
Thermocouple Lengths to 50 feet
Complete Thermocouples made to every requirement

NEW, SIMPLE CONSTRUCTION
Made from metal sheath over ceramic insulated thermocouple wire. Metal sheath can be bent and weldments can be performed without loss of insulation.
Write for Bulletins ▶ 3.8 for complete thermocouples. 4 for ceramic insulated wire.

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GOT A SEPARATION PROBLEM?

READ THIS BOOKLET
LEARN HOW TO SEPARATE

✓ OIL AND LIGHTENDS FROM GAS
✓ CARRYOVER FROM VESSELS
✓ COMPRESSOR OIL AND CONDENSATE FROM GAS & VAPOR
✓ MOISTURE AND OIL FROM STEAM

If you have one of the above separation problems, write for Anderson's free purification booklet. Here you'll learn the most efficient method yet developed for separating mist, liquid, or particles from any gas or vapor. Anderson's purifiers, scrubbers, and mist extractors are absolutely maintenance free. There are no moving parts, filters or screens that require servicing. Results are guaranteed. Outline your problem to us today.

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Please send your purification booklet without obligation.
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Company _____
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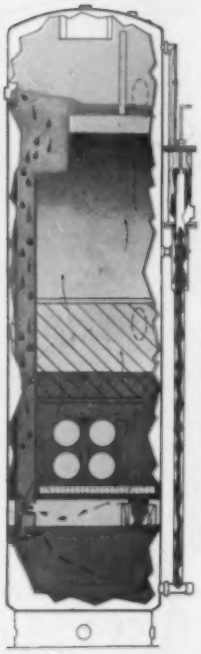
PURIFIERS • SCRUBBERS • SEPARATORS • MIST EXTRACTORS

T1 Pressure Treater

The Sauder pressure treater gives you the biggest bunch of on-the-job advantages you can get in oil-treating equipment.



Positive oil retention for maximum degassing and preheating

Free water knockout high capacity, no wasted heat

High-efficiency mist extractor for top gas scrubbing

Reversible twin U-tube furnace doubles furnace life

Furnace rides I-beam track for easy removal

Exclusive Sauder wind hood for dependable furnace operation

Redwood tray filter section corrosion proof

Quick-adjusting water level takes minutes, not hours

Big manways in each compartment for safe, easy inspection

50 PSIG working pressure for flexibility, max. recovery

Best controls available for pressure operation

Inside & Out

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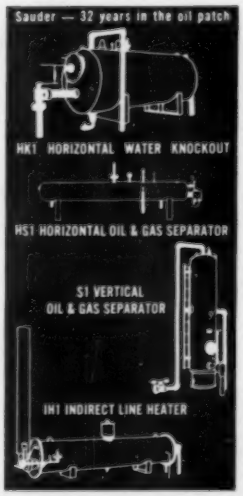
When you hook the Sauder pressure treater into your line you get the top possible dollar coming in, fewest going out. You get rock-bottom upkeep, minimum downtime. You don't even have to shut down the Sauder treater when adjusting the water level—takes but minutes with the Sauder siphon. Twin U-tube furnace is reversible for double life. Whatever you want in a pressure treater, you get it most in the Sauder T1. 4 ft. to 10 ft. diameters, treating capacities up to 4,000 bbls. of oil per day . . . *Write, wire, or call 403 collect . . .*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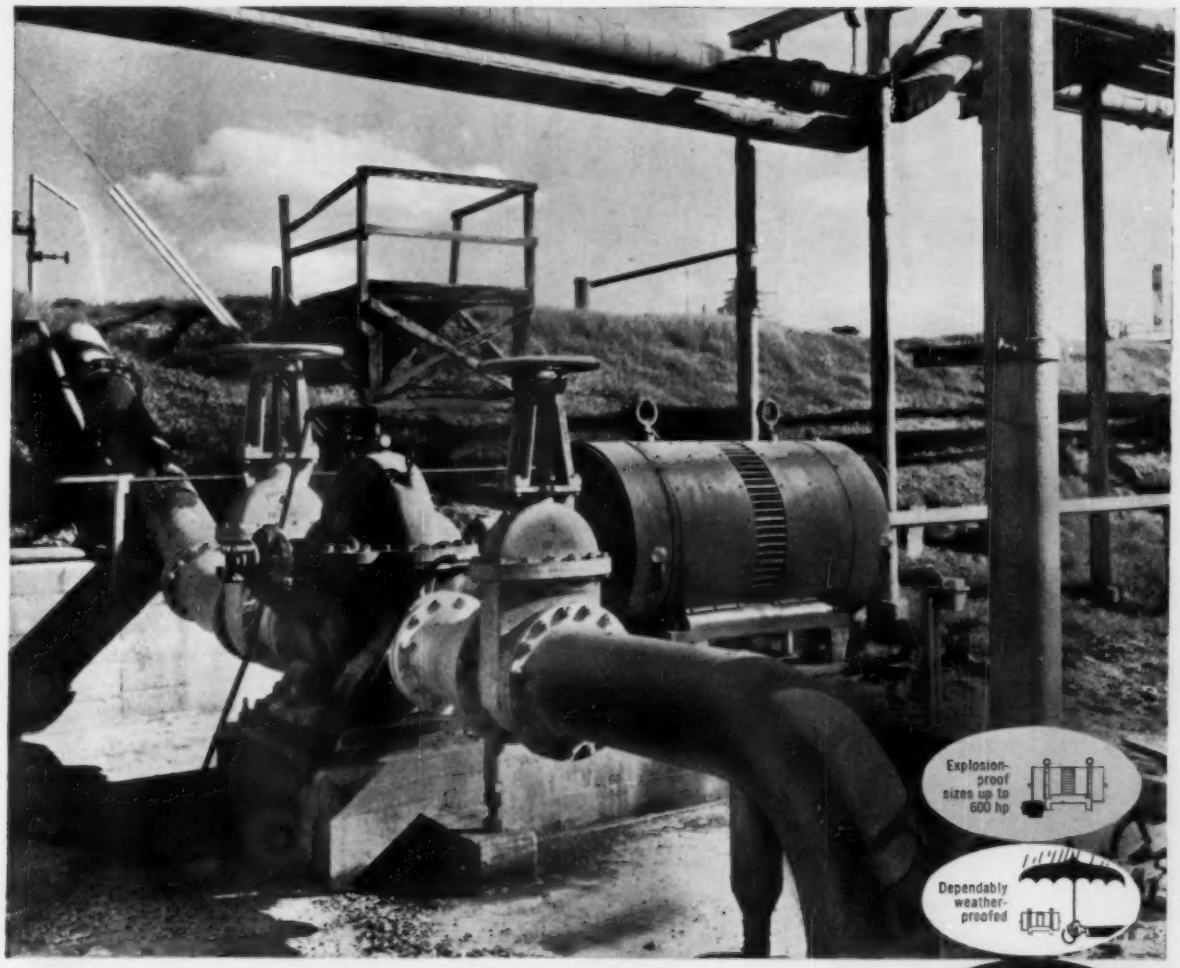
7	Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus, Ohio.
10-13	American Association of Petroleum Geologists and Society of Economic Paleontologists and Mineralogists, forty-third annual meeting, Biltmore Hotel, Los Angeles.
12-14	American Petroleum Institute, Division of Production, southwestern district meeting, Hotel Texas, Fort Worth.
17-21	National Association of Corrosion Engineers, annual conference, civic auditorium, San Francisco.
17-21	International Atomic Exposition, Inc., 1958 Nuclear Congress, Chicago Amphitheatre, Chicago.
20-21	Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, regional conference on production and reservoir engineering, Mayo Hotel, Tulsa.
24-26	Midwest Gas Association, Broadmoor Hotel, Colorado Springs, Colo.
31-April 2	American Petroleum Institute, Division of Transportation, annual pipeline conference, Jung Hotel, New Orleans.

APRIL

1-3	University of Oklahoma, fifth annual conference on corrosion control, Extension Study Center, Norman, Okla.
9-11	American Petroleum Institute, Division of Production, Mid-Continent district meeting, Biltmore Hotel, Oklahoma City.
15-17	University of Oklahoma, thirty-fourth annual gas measurement short course, North Campus, Norman, Okla.
16-18	Natural Gasoline Association of America, annual convention, Baker and Adolphus Hotels, Dallas.
17-18	American Institute of Mining, Metallurgical, and Petroleum Engineers, Louisiana-Arkansas, East Texas, and Mississippi petroleum sections, gas technology symposium, Shreveport, La.
20-23	American Institute of Chemical Engineers and Chemical Institute of Canada, chemical engineering division; Canada-U.S. chemical engineering conference, Montreal.
21-23	American Petro'eum Institute, Division of Production, Rocky Mountain district meeting, Cosmopolitan Hotel, Denver.
27-29	Independent Petroleum Association of America, midyear meeting, Hotel Sherman, Chicago.
27-30	American Association of Petroleum Geologists, Rocky Mountain section, Casper, Wyo.
28-29	University of Oklahoma, third annual conference on automatic control in the petroleum and chemical industries, Oklahoma Memorial Union Building, Norman, Okla.

MAY

5-6	Society of Petroleum Engineers of A.I.M.E., North Texas section, secondary-recovery symposium, Wichita Falls, Tex.
12-16	American Petroleum Institute, Division of Refining, midyear meeting, Statler Hotel, Los Angeles.
21-23	American Petroleum Institute, Division of Marketing, midyear meeting, Roosevelt Hotel, New Orleans.
22-23	American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.



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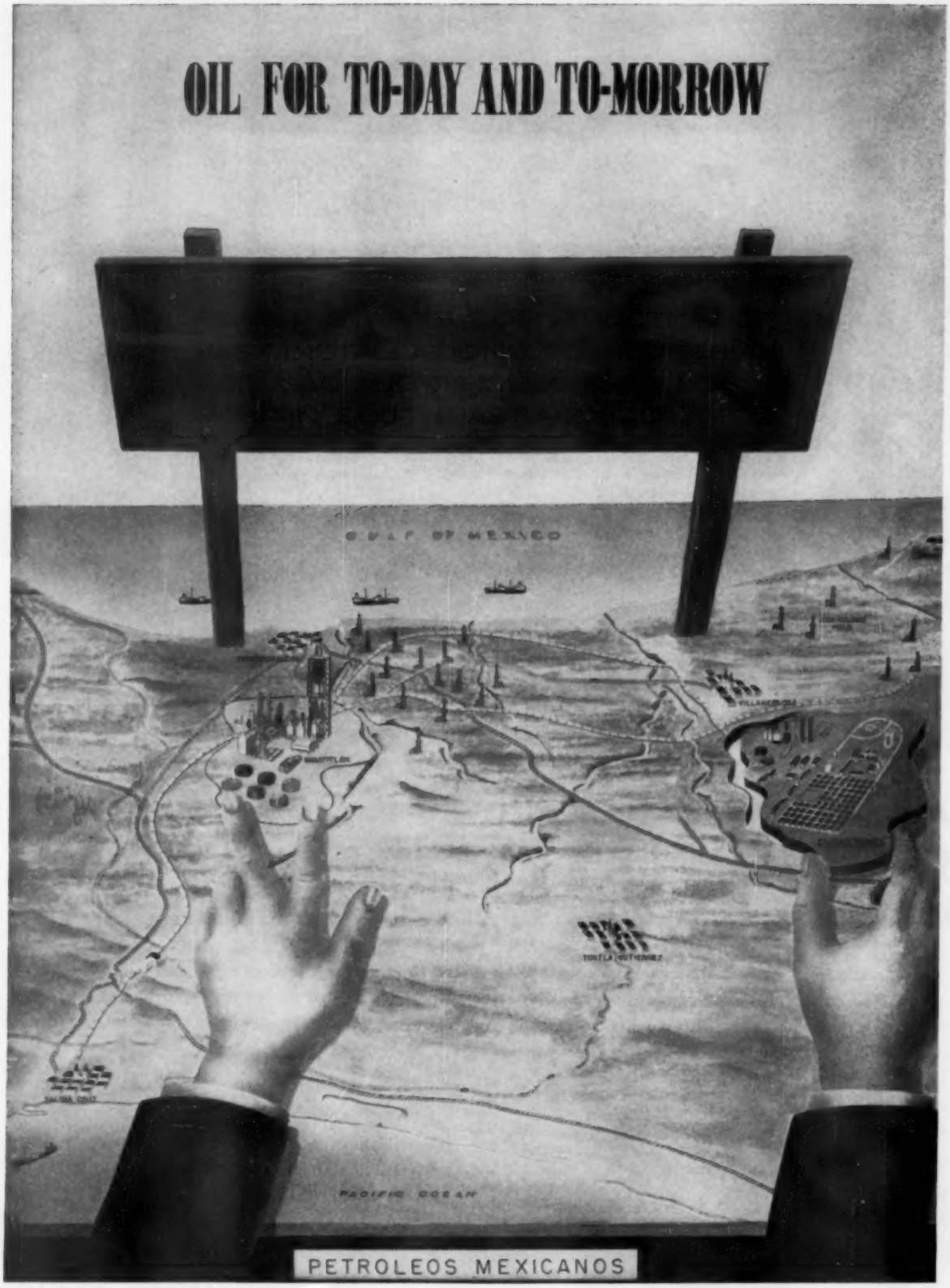
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the OIL AND GAS JOURNAL

TULSA, OKLAHOMA

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JOURNALLY SPEAKING

Dog-Gone Sputnik

THOSE RUSSIANS are simply ruining the oil industry's public-relations program. The whole thing has gone to the dogs—space-traveling dogs.

Who wants to listen to how good oil is when all the talk is about Sputniks sailing around over our heads?

Notice how diabolical the Russians are in timing their campaign against oil. They knew very well that the U. S. oil industry had scheduled its Oil Progress Week for October 13-19. This was to be the time when the whole world was to be told about how progressive oil men are, how they are away ahead in scientific and technological advances, well prepared to meet all problems of national defense and the whims of consumers.

But just when the big hoopla was about to start, the darned Russians jerked the rug out from under it all by launching their first earth satellite.

By the light of the Soviet moon nobody wanted to spoon with the oil industry. All thoughts were about progress, to be sure, but about the progress of rockets, missiles, space ships, nuclear energy—anything but oil progress.

Sputnik monopolized the news day after day. What was planned as Oil Progress Week turned out to be Russian Progress Week.

It's a shame, too, because the oil P.R. boys had a lot of nice things ready for that week. They had worked up parades, banners, window displays, prize contests, and all sorts of other gimmicks calculated to demonstrate how wonderful oil is.

And they hadn't overlooked the ladies, either. In many places they had planned neighborhood parties with games, favors, and entertainment hung on oil, and a "Black Magic" dessert as a clincher to prove oil's progress. They even had cute little brochures telling the womenfolk how to put on their lipstick and assuring them that they are more beautiful when they use cosmetics with petroleum bases.

But such tried and true attention-getters couldn't hold a candle to Sputnik. Its beep-beeping from outer space drowned out the voice of oil.

But finally Sputnik quieted down and people stopped craning their necks toward the heavens for a sight of it, and the oil men figured they could get back into public attention by staging a big A.P.I. meeting in Chicago. But the sneaky Russians heard about that so they launched this dog-gone, canine-carrying Muttnik and stole the show again.

But that's not all. Now the Russians are hinting that they have developed some superfuels, not based on oil at all. Obviously this is designed to poison the minds of the American people against the whole oil industry.

Who will care a hang about the future of smelly old crude oil if the future is going to be shaped by new fuels, new energy sources, new scientific wonders from behind the Iron Curtain? What's oil progress compared with missile progress?

We have concluded that the whole purpose of this Russian Sputnik program is to make the American people believe that the petroleum industry is a has-been and that oil isn't necessary any more. Then maybe people will begin to doubt that oil can win another war for them and won't be so smug about the Free World having so much oil and the Russians having so little. (At least we don't think the Russians have much oil. But we didn't think they had any Sputnik, either).

People are saying that the Russian success with space ships and satellites means that we will have to reshape all our thinking and find new ways of doing everything.

In any event, it seems obvious to us that the boys on the Oil Information Committee will have to think up some bigger and better publicity gimmicks for next year if they want their story to compete for the attention of the world.

The Russians sure out-gimmicked them with their Sputnik this year.

—*Henry D. Ralph.*

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There are ways to beat these things

THIS old world sure has gone haywire, hasn't it? A fellow hardly knows what to think.

The Russians are shooting missiles over us and boasting they can shoot them at us. It's said we are laggard in scientific progress.

A general business recession is being predicted; the stock market is doing dips and dives; and the demand for oil is on dead center.

The Middle East is in turmoil. War scares abound. And now we are being harassed by flying saucers and phantom lights.

SHOULD WE RUN AND HIDE? First let's find out what there is to run from. Let's not panic like Chicken Little, who was hit on the head by a leaf and announced that the sky was falling. Let's see what it all adds up to.

It adds up to a bunch of unexpected (and generally unrelated) things. But most of them could have been expected if we had used our foresight and acumen more diligently.

And (unless you want to make an exception of the flying saucers) all of them can be explained in terms of known physical, economic, and psychological factors. This means that they can be dealt with by logical application of these same forces.

What we're faced with, then, is simply a group of radically changed conditions that may require us to make equally radical changes in our thought patterns and action habits. This doesn't spell despair. It spells challenge.

Sure, it shocks us to find that the Russians have beaten us in one field of science. But does anyone doubt that we can catch up if we put our minds to it? And don't undersell our tradition of achievements in other lines, nor our potential for still greater scientific progress.

Yes, the general business boom seems to be over. But we've had business recessions every few years all through our history. And every other time smart men found ways to make a living.

And as for oil demand—well, next year it will be about the same as this year, instead of the accustomed 3 or 4 per cent increase. But it's still the highest in history. And oil is as nearly depressionproof as an industry can be.

THE CHALLENGE IN ALL THIS is the challenge to face changed conditions. And the American people and the American oil industry are still the world's champions at this. Our resourcefulness and our adaptability are our greatest assets.

Instead of feeling helpless in the face of any or all of these unexpected developments, let's attack them with the means at our command. There are ways to beat these things, and we can find the ways if we get out of our mental ruts and work at it.

A Tribute

John W. Newton
President and General Manager
Norvell-Wilder Supply Company

I want to pay tribute to an institution that has contributed immeasurably to the advancement of the oil industry — the American Petroleum Institute.

It was my good fortune to have served the A.P.I. as vice president of the refining division and as a director. So I know how many hours of hard work are done by men serving as officers and on committees. A good example of their accomplishments is the standardizing and development of equipment.

I know the value of this work from my having been on the *buyer's side of the fence* while serving for two decades as vice president and general manager of refining for the Magnolia Petroleum Company. Now, it is my pleasant duty to know the value of the work done by the A.P.I. from the *seller's side of the fence* from my position as president and general manager of the Norvell-Wilder Supply Company.

My good wishes go out to members of the A.P.I. and all who are working diligently to further the progress of one of the world's most dynamic industries, and from the standpoint of the strength and security of our nation, one of the most important—OIL.

By John W. Newton

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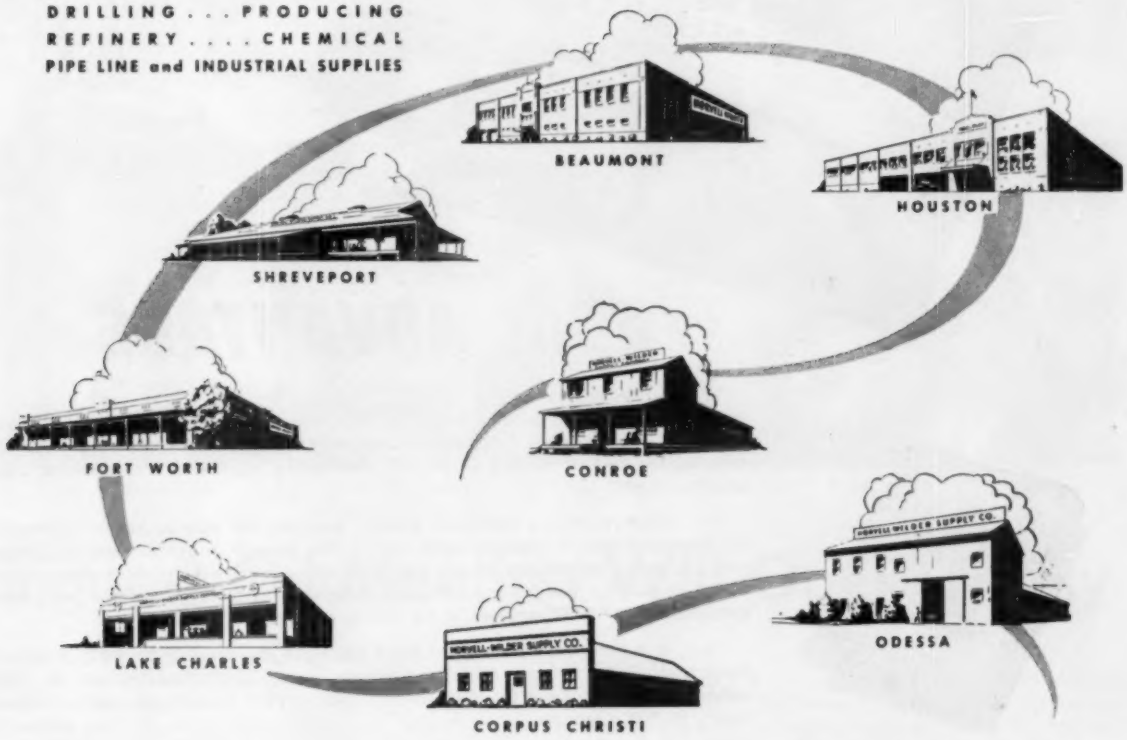

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the OIL AND GAS JOURNAL

November 11, 1957

These men will play key roles in the A.P.I.'s general sessions

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A.P.I. board chairman

FRANK M. PORTER
A.P.I. president

E. M. DIRKSEN
U. S. Senator

P. D. REED
General Electric Co.

R. S. KERR
U. S. Senator

C. H. LYONS
Lyons & Logan

Biggest Oil Meeting Will Open Today

CHICAGO.—The top gathering of the oil industry—annual meeting of the American Petroleum Institute—opens a 3-day run today in Chicago's Conrad Hilton hotel.

Hundreds of oil men have been in town since last Thursday attending scores of special committee meetings dealing with every conceivable oil-industry subject.

The committee sessions will continue through Wednesday, closing day of the convention. They will be interrupted only for this afternoon's general session, another such gathering Wednesday morning, and the several group sessions of A.P.I. divisions.

By the time Wednesday night rolls around, the some 6,000 delegates expected will have heard special reports and talks by experts on nearly every problem of the industry.

Main speaker for this afternoon's general session is Sen. Robert S. Kerr of Oklahoma, board chairman of Kerr - McGee Oil Industries, Inc. Wednesday morning's general session will hear addresses by Philip D. Reed, of General Electric Co., Sen. Everett M. Dirksen of Illinois, and Charlton H. Lyons, Mid-Continent Oil and Gas Association president.

Heavy work of the convention takes place in group sessions of A.P.I. divisions. They will be held at the Conrad Hilton, except for the Transportation Division which will meet at Palmer House.

Highlights of these sessions:

. . . **Production** speakers will discuss depletion provisions, need for excess producing capacity, voluntary imports control, personnel training, and oil operations abroad.

. . . **Refining** men will be treated to an array of top speakers on the problem of static electricity in handling oil products.

. . . **Marketing** session will discuss the job of selling lubricants.

. . . **Transportation** agenda includes talks on the federal highway program and possibility of nuclear tankers.

. . . **Other sessions** will take up the business outlook, oil demand, research, employe health, and public relations.

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W. D. CROSS, JR.
Sinclair Refining Co.

E. A. CUNNINGHAM
Shell Oil Co.

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Pure Oil Co.

D. M. HILLS
Sinclair Refining Co.

F. H. MEEDER
Richfield Oil Corp.

H. E. PRUNTY
Standard Oil Co. (Ind.)

A.P.I. to Honor 37 Industry Leaders

CERTIFICATES of appreciation for long and valuable service to the oil industry will be presented to 37 oil men at the A.P.I. convention this week.

The Oil Information Committee and the A.P.I. divisions of production and transportation will each be awarding eight certificates. Three awards will be made by the Division of Marketing, and one by the Division of Finance and Accounting. Four oil men will be cited for work in fundamental research and the following A.P.I. committees will each make one award: crude-oil measurements, safety and fire protection, reserves, statistics, and American Petroleum Industries Committee.

Certificates will be presented during committee meetings and group sessions. The crude-oil measurements committee will make its award on Sunday. On Monday fundamental research, safety and fire protection, finance and accounting, oil information, and transportation certificates will be awarded; Tuesday, marketing, petroleum reserves, production, and American Petroleum Industries committee; Wednesday, petroleum statistics.

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Standard Oil (Calif.)

L. E. FITZJARRALD
Phillips Petroleum Co.

R. O. GARRETT
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Division of Production

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Petroleum Statistics

HENRY SCHWALL
Shell Oil Co.

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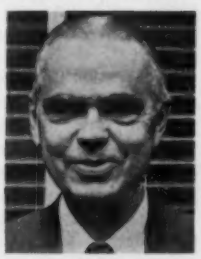
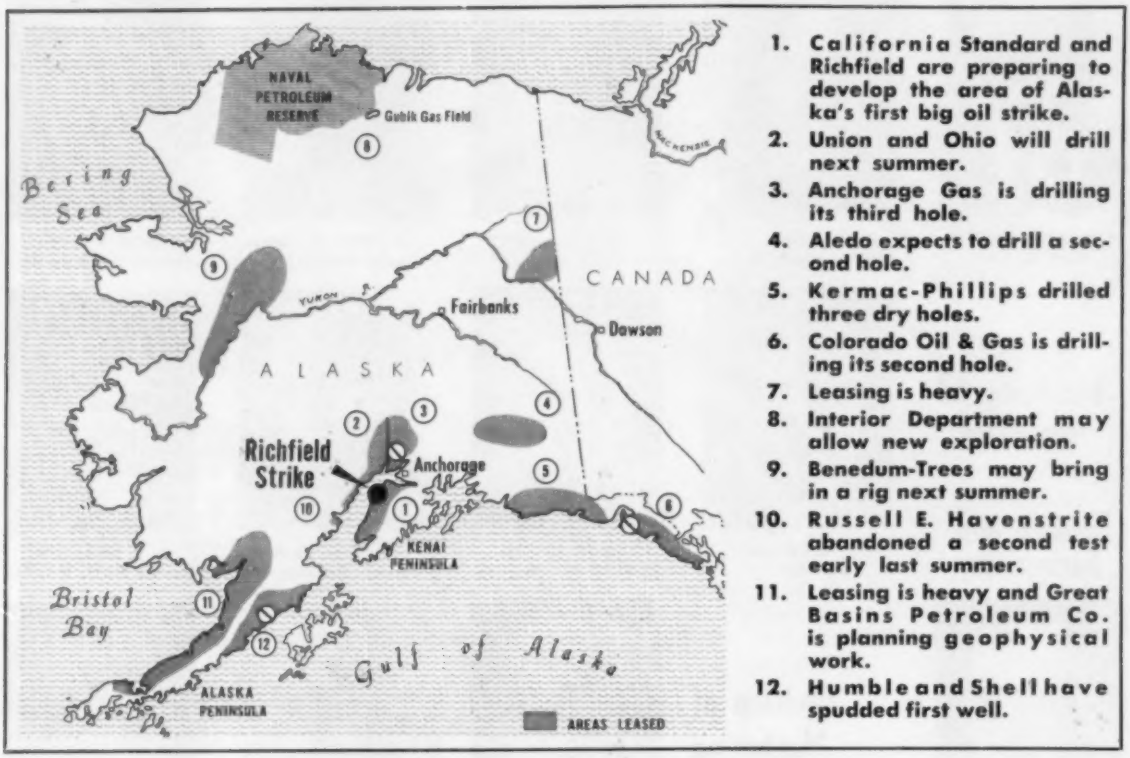


H. C. PACKARD
Shell Oil Co.

Alaska's Booming With Oil Exploring

The Richfield strike on Kenai Peninsula has spurred activity not only at Kenai but elsewhere in the territory. California Standard is ready to spend $30 million for tests. Government is bogged down processing lease applications, but the drilling rush is on.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Anchorage
KENAI PENINSULA
Bristol Bay
Gulf of Alaska
ALASKA PENINSULA
AREAS LEASED
1. California Standard and Richfield are preparing to develop the area of Alaska's first big oil strike.
2. Union and Ohio will drill next summer.
3. Anchorage Gas is drilling its third hole.
4. Aledo expects to drill a second hole.
5. Kermac-Phillips drilled three dry holes.
6. Colorado Oil & Gas is drilling its second hole.
7. Leasing is heavy.
8. Interior Department may allow new exploration.
9. Benedum-Trees may bring in a rig next summer.
10. Russell E. Havenstrite abandoned a second test early last summer.
11. Leasing is heavy and Great Basins Petroleum Co. is planning geophysical work.
12. Humble and Shell have spudded first well.

WHEN ALASKA'S first producer came in last July, it climaxed more than 55 years of oil hunting in the big territory and today has set off a wave of new leasing.

Richfield Oil Corp.'s wildcat on Kenai Peninsula proved what geologists have believed to be true for many years but never had been able to prove with finality—that there's oil beneath the land ringing the Gulf of Alaska.

Since the 1 Swanson River unit reported success on the northwest corner of Kenai, more than 13 million acres have been filed on for drilling rights in Alaska. Heavy filing is expected to continue.

The biggest program is in the works for Kenai itself, but the new activity is spread throughout the territory and may even extend to the Arctic Circle, where development has been dormant in the government-controlled Gubik gas field area.

John Roderick of the Alaska Scouting Service has made a survey of development plans for the territory and released his findings to The Oil and Gas Journal last week.

Long wait . . . Since the turn of the century prospectors have searched for oil in Alaska, and the first production actually was found in 1901, when Chilkat Oil Co. drilled 366 ft. in an oil-seep sector near the present Phillips Petroleum Co. lease in the Katalla-Yakataga area.

There were other spurts of activity and small production, but the modern interest in Alaska started in the 1950's when the Government opened large tracts to leasing.

But even this interest was slow in developing.

Then came the July 23 Richfield strike on Kenai and with it the flood of leasing applications.

The U. S. Bureau of Land Management reports it is far behind processing applications. In Anchorage alone there are 3,500 applications awaiting action because of a shortage of adjudicators. Lack of funds to hire new personnel is handicapping the agency and consequently slowing the pace of new exploration.

The initial rental revenue to the territory will amount to $3,250,000, but it cannot be paid until the applications are adjudicated and then granted.

Kenai operation . . . Standard Oil Co. of California and Richfield are lead-

ing the way on Kenai Peninsula with a joint drilling program to find out just what the July strike really means.

Standard has agreed to spend $30 million over the next several years exploring Richfield's and its own holdings on the Kenai. Richfield controls 89½ per cent of the 71,680-acre Swanson River unit, and the rest is owned jointly by Union Oil Co. of California and Ohio Oil Co. Richfield also has another 100,000 acres surrounding the unit.

California Standard has 250,000 acres in a development contract with the Interior Department on the southern end of Kenai. Both these and the Richfield lands are included in the joint drilling deal, under which some eight wells will be drilled in the next 2 years if government clearance can be obtained.

The Swanson unit is in the Kenai National Moose Range, a wildlife refuge under supervision of the U. S. Fish and Wildlife Service. Richfield is the only company thus far able to drill in the range. Government restrictions have limited the geophysical work to a minimum of seismic work and, since the Richfield discovery, have prohibited it entirely.

However, newly proposed regulations from Interior affecting oil and gas drilling in wildlife refuges specifically exempt Alaskan refuges from some of the more strict provisions. If adopted by Secretary Fred Seaton as proposed, drilling would be permitted within the Moose Range, subject to local conservation requirements drawn by the Bureau of Land Management and the Fish and Wildlife Service.

California Standard was the first oil company to do major exploration work in Alaska. Its $30 million deal with Richfield indicates its intention to maintain its No. 1 position in the territory.

The majors began leasing the Kenai Peninsula early in 1953. California Standard, Richfield, Union - Ohio, Shell Oil Co., Sunray Mid-Continent Oil Co., and General Petroleum Corp. all took blocks. Since discovery of Richfield's 900-bbl. well, all of these have added to their holdings, and Phillips Petroleum Co. and The Texas Co. have entered the play.

Yakataga activity . . . East of Kenai, in the Yakataga district on the Gulf of Alaska, Phillips and Kerr-McGee Oil Industries, Inc., have spent nearly $8 million drilling three tests without finding oil in commercial quantities.

But their efforts have not necessarily ended, even though two rigs have been shipped back to the U. S. The last well was abandoned at Icy Bay at 12,054 ft.

Since the Kenai discovery, Phillips has maintained its offices in Alaska and is keeping control of nearly all its 1,000,000-acre development contract in the Katalla-Yakataga province. It has turned back to Yakutat Development Co. leaseholders 182,000 acres in lieu of drilling a well in the Katalla district.

The Yakataga district, however, is still being explored—this time by Colorado Oil & Gas Corp. Colorado was the third company to be awarded a development contract in Alaska and is presently drilling its second hole near the town of Yakutat, south of where Phillips drilled.

Colorado controls nearly 1¼ million acres and has been doing extensive geophysical work in the area for the past two seasons. Its partner in the Alaskan venture is Frankfort Oil Co.

Alaska Peninsula . . . Across the Gulf of Alaska to the west, Humble Oil & Refining Co. has spudded its Humble-Shell Bear Creek Unit No. 1 on the Alaska Peninsula.

In a joint venture with Shell, Humble agreed to drill three wells on acreage held by Shell in the Puale-Wide Bay area northeast of Kanatak on the east side of the peninsula.

This big producer on Kenai Peninsula put new life into Alaskan oil exploration. It's Richfield's 1 Swanson River Unit in northwest Kenai.

Approximately 250,000 acres is involved in the deal, and Humble, as operator, will share 50-50 with Shell.

On the west side of the Alaska Peninsula, the entire tertiary basin on the east side of Bristol Bay has been leased. Great Basins Petroleum Co., Denver, is the only company which appears so far to be planning any geophysical work in the area. Lease play, however, has been tremendous, and there may be some consolidation of leases for geophysical work.

Just north of the Alaska Peninsula and across from Kenai, Russell E. Havenstrite, a Los Angeles independent, abandoned his second drill test on the Iniskin Peninsula early this summer. He first drilled in 1938. The second well went to 9,747 ft.

Around Anchorage . . . There's plenty of activity, but no real oil show yet, north and west of Anchorage at the head of Cook inlet.

Anchorage Gas & Oil Development Co., a local operator, is drilling its third hole at Houston, just north of Anchorage. Since the Kenai discovery, majors have leased land surrounding the area and are negotiating for farmout deals.

Union and Ohio have taken over about 80,000 acres in the Goose Bay block northwest of Anchorage. The

acreage formerly was held by Alaska Gulf Oil & Gas Development Co., a local company that drilled a 3,855-ft. test in 1955 before abandoning.

Union, as operator, plans to do geophysical work beginning this winter before starting actual drilling next season.

In the Eureka area, about 125 miles east of Anchorage, Aledo Oil Co. of Fort Worth is expected to drill its second hole next summer. Majors also are leasing land surrounding this area and seeking farmout deals.

Farther north . . . Two areas in West Central and East Central Alaska are seeing activity, though no wells have been drilled.

Benedum-Trees Oil Co. has had geophysical crews in the Kateel-Koyukuk River area 300 miles west of Fairbanks for the past two seasons. Benedum controls about 600,000 acres in the interior region and is expected to bring in a rig next summer if geophysical findings are favorable.

Leasing has been heavy in the region and is expected to continue. The same conditions exist across Central Alaska on the eastern border with Canada in the Porcupine-Kandik River region.

The Far North . . . In the Arctic Circle region of northern Alaska there are also prospects of renewed activity, particularly in the Interior Department-controlled land south of the Naval Petroleum Reserve.

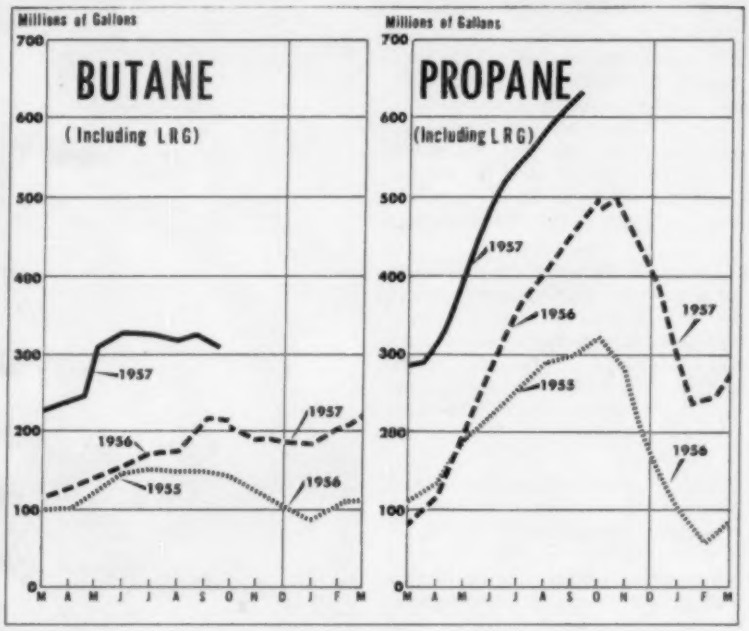
The Naval area has reserves estimated at 60 million barrels of oil and 300 billion cubic feet of gas, but drilling was suspended in 1953 before any extensive examination of the region could be made.

Recent indications are that Interior will open its area just to the south, and if this occurs the first exploration will be in the Gubik gas field area, which is on the edge of the Naval Reserve. Gubik's gas reserves alone are estimated at more than 200 billion cubic feet.

Interior has been studying for more than 2 years a plan to open for leasing some 20 million acres of northern Alaska land that drains into Arctic Ocean but is outside the Naval area.

Until Richfield hit oil at the opposite end of Alaska, the Gubik field represented the only production of consequence in the territory. Operations were suspended in 1953 after a 9-year $36-million exploration program by the Navy. The late President Franklin D. Roosevelt created the petroleum reserve.

L.P.G. Storage Hits Its Seasonal Peak



Propane Price Jumps ½ Cent

WARREN PETROLEUM CORP. last week raised the price of propane and butane-propane mix ½ cent a gallon. The boost was made effective November 8.

The seasonal increase came much later than last year's 1-cent increase posted in September. The new price of 4½ cents, Warren said, probably will be the top price for the coming heating season. It's ½ cent below last winter's 5-cent high.

The company said several factors had a bearing on the price hike:

. . . Production is down. Low allowables in some states have cut L.P.G. output. Warren's propane production is down 5,000,000 gal. per month.

. . . Demand is up. October was colder than the 10-year average, and much colder than last year's abnormally warm winter.

Not only is house-heating demand up, but so is chemical demand for L.P.G., especially for making butadiene.

A new factor is the industry's sudden interest in L.P.G. as a means to boost oil recovery. New miscible-phase displacement programs require a good deal of L.P.G. at the outset of each project. These were felt for the first time this year.

. . . Railroad freight rates were boosted again in August. Rates rose 6 per cent on lines running from the Southwest to the northern and eastern parts of the nation.

Price picture . . . Warren's daily average price for L.P.G. for the 1947-56 period was 3.91 cents per gallon. G. L. Brennan, vice president in charge of Warren's LP gas division, said he expects the average price for 1957 will be similar to the 10-year average.

In the past year and a half, Warren's L.P.G. price has fluctuated between 3½ and 5 cents per gallon.

The price was firm during the summer of 1956 at 4½ cents. In September it went up to 5 cents, held steady during the heating season, and dropped to 4 cents the following March.

In June the company gave a ½-cent summer discount, dropping the price to 3½ cents. In September this year the price went back up again to 4 cents.

Underground storage . . . The industry has more L.P.G. than ever in underground storage (charts). Since underground storage came into use 7 years ago, the industry has made room for nearly 34,000,000 bbl. of L.P.G. (OGJ, Oct. 14, p. 101).

This has resulted in a firmer supply and a more stable flow of L.P.G. during peak winter months. Another big increase in L.P.G. storage capacity is expected again next year.

Oil Goes to Money Well

Clatter of the ticker tape takes on new meaning to oil finance managers needing money for future expansions

THE UPS and downs of the New York Stock Exchange take on added significance to oil-company finance managers these days.

Economists feel this will be even more true in the future.

One trend has developed in the past few years in oil-company financing: Companies are turning more and more to outside sources for money to carry on their expansion programs.

The huge outlays needed in the future (see pp. 135-142) to meet continued heavy demand for petroleum products will accent this policy.

Oil companies, probably more than in any other industry, have financed the bulk of their expansions in the past through their own capital. These funds came from retained earnings and capital-extinguishment charges.

The industry will continue this practice but also will keep finance managers going into the money markets to pick up the rest of the cash needed.

The outlook . . . The domestic oil industry will spend $80,250,000,000 on capital projects between now and 1966. Another $49,750,000,000 will be spent abroad.

Chase Manhattan Bank economists estimate that capital spending by the oil industry in the United States from 1957 to 1961 alone will total $35,275,000,000. The annual outlay will rise from $6,325,000,000 in 1957 to $7,825,000,000 in 1961.

The totals by divisions for those years are: Drilling and production, $25,625,000,000; refineries and chemical plants, $4,850,000,000; transportation and marketing $4,800,000,000.

Where's the cash? . . . The industry likely will have to borrow $3,375,000,000 from outside sources to help finance this expenditure.

Here's the balance sheet: Retained cash income from 1957-61 is put at $31,900,000,000. Capital expenditures of $35,257,000,000 leave a deficit of $3,375,000,000 to be financed. These figures result from a net profit of $39 billion and payment of about $8 billion in dividends.

This use of outside funds has been even greater during the last 5 years. From 1952-56 oil-industry expenditures totaled $26,425,000,000. These were covered by $21,942,000,000 from retained cash and income and $4,483,000,000 from outside sources. In 1954 alone the industry had to find $1,082,000,000 in outside financing to cover its operations.

That's why company finance managers have such an increasing interest in stock values. For instance, it's known that Standard Oil Co. (N. J.) and the Royal Dutch - Shell Group both are planning to sell more stock soon. Jersey Standard plans to raise about $250 million and the Royal Dutch - Shell Group $360 million. Other oil companies reportedly will follow these two giants to the money well.

Many securities experts, however, feel that the companies probably will wait until the market for common-stock equities firms before undertaking the financing programs. Because of recent declines in stock values, new equities now would not raise enough cash and present stockholders would not favor seeing their holdings diluted. The stock market ticker thus is influencing oil-company operations more and more.

Imports Review Planned

Signs of excessive West Coast stocks prompt Carson to take another look; extension of controls may result

WASHINGTON.—The cabinet fuels committee will review the import situation on the West Coast next month. Its review may lead to including that area under the voluntary-control program.

First step in the study will be a 2-day public hearing opening November 25 before Capt. M. V. Carson, Jr., administrator of the program. All interests in the West Coast district have been invited to give their views.

Carson also has asked the 10 West Coast importers to submit their programs for the first half of 1958 by November 23. These are expected to show a marked increase in imports over present schedules.

At present West Coast imports actually are not subject to any controls. The cabinet committee merely took the importers' schedules as a guide to what volume of imports might be expected, but promised to keep a watch on developments.

Reports from the West Coast indicate that continuing high rates of imports have pushed total petroleum stocks in the region to a new postwar high. The end of the rise probably has not been reached.

The picture . . . Stocks of petroleum in the five western states by the end of October reached 135,000,000 bbl.

This represented a year's increase of about 23,000,000 bbl. Previous 20-year high point was 131,339,000 bbl. registered in September 1949.

Stocks of crude and all principal products individually also are well above a year ago. They showed:

. . . Crude—36,400,000 bbl. at the end of August, up 3,270,000 bbl. from a year ago.

. . . Residuals—24,000,000 bbl. at end of October or more than 8,000,000 bbl. higher than year before.

. . . Gasoline and heating oils—both showed gains of about 3,000,000 bbl. in a year's time.

Cause of this increase can be traced directly to imports. During first 6 months of 1957, imports averaged 232,000 bbl. daily, about 72,000 bbl. higher than for the same period in 1956. During the past 4 months the average has been even higher, almost 300,000 bbl. daily.

Stark Fox, executive vice president of the Oil Producers Agency of California, has warned that the West Coast is headed for serious trouble if imports are not controlled. He recommended that imports be reduced to 187,000 bbl. daily in the last quarter and to 194,000 bbl. during the first half of 1958.

Due for change? . . . The current imports quota for the West Coast is 296,000 bbl. daily.

The cabinet committee in its recent report declared it had reason to believe imports would not top 275,000 bbl. daily.

But Washington officials now cite several factors which make a prompt review of West Coast imports advisable:

. . . Protests against excessive imports by California producers.

. . . Plans by at least one company not importing now to start bringing in foreign crude next year.

. . . More domestic oil being made available to California refiners from the new Four Corners pipeline.

Engine Makers On Spot

General Motors research chief criticizes today's motor, challenges engineers to turn out a better one in future

CLEVELAND.—Automotive engineers heard some straight talk from one of their brothers last week. They were told that today's engines don't do a good enough job full time in using the energy available in high-octane gasoline.

The occasion was the Society of Automotive Engineers national fuels and lubricants meeting. The speaker was John M. Campbell, scientific director of General Motors Corp.'s research staff. He delivered the principal talk as recipient of the Horning Memorial Award.

The engine designer has his job cut out for him from here on, said Campbell. He can't get along by just boosting compression ratios every year. With engines at 10:1 compression ratio and premium fuels at 100 R.O.N., engineers have reached a point where not much can be gained in fuel efficiency by further increases in compression ratio alone.

Some changes . . . What else is needed? Campbell said better control of ignition timing and air-fuel ratios and a more uniform engine design challenge the automotive engineer to make more use of the chemical power in today's gasoline. The refiner in turn will need to modify the hydrocarbon structure and boiling range of gasoline.

Throughout the era of rising gasoline octanes, engines have been using the full value of octanes only a small fraction of total operating time. Octanes hvae served as a cushion against variations in ignition timing, combustion-chamber deposits, and other factors varying from one car to another. At present levels of gasoline octane, designers can ill afford not to make the best possible use of this fuel, Campbell said.

Campbell then called for a hard look at today's simple ignition-timing mechanism which performs a complex control function. The automotive industry should find out if a more perfect control would improve fuel economy enough to be worth the added cost and servicing complications. The speaker declared air-fuel ratios vary by as much as 5 to 6 units, representing a 35 to 40 per cent difference in fuel consumption. Better design and control could mean 400 to 500 miles of free transportation to the average driver every year.

Campbell also raised some points which haven't been discussed for a long time. He said engine designers may want to:

. . . Retain and even increase compression ratios to improve part-load efficiency.

. . . Retain performance with supercharging or with engine compounding in some form when high-power outputs are needed.

. . . Take another look at dual-fuel systems, water injection, supplemental fueling and other devices which have not seemed commercially feasible.

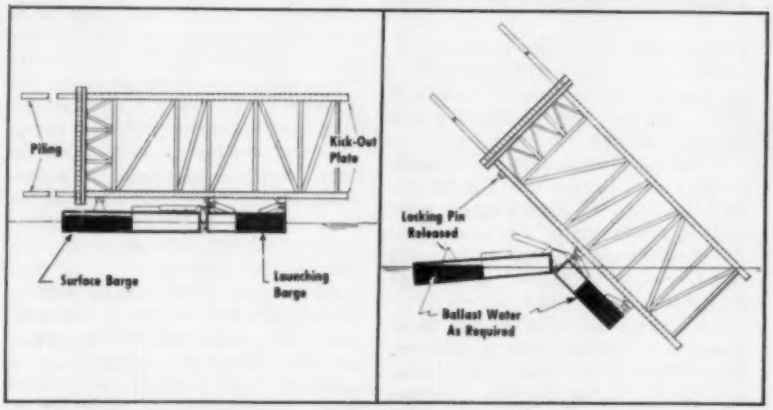
Worth an oil field . . . The stakes are getting bigger for engine designers. Campbell declared that 10 years from now 80 million registered vehicles will consume 65 to 70 billion gallons of fuel per year. At this rate an unparalleled chance for "discovering" new oil fields is presented to the automotive engineer who can increase the efficiency and economy of cars.

What of the gas turbine, or the free-piston engine?

Campbell made no mention of either. Pointing to the present engine type as most suitable for many years to come, he still conceded that it is a wasteful means of converting chemical to mechanical energy. A real technical breakthrough is needed, he said, to improve on this type of heat engine that uses only 20 to 40 per cent of the energy it consumes.

No one today has the slightest idea how such a breakthrough might be brought about, he said. But electrochemical and thermoelectric processes offer encouragement, although none of them would be competitive with

New "Hinge" Barge Developed



Platform arrives on barge . . . Launching barge unhinges . . .

HOUSTON.—A barge designed specifically to transport and erect offshore drilling platforms soon will be ready to go to work in the Gulf of Mexico.

The hinged barge is intended to replace expensive derrick barges in setting up tender-type platforms. It is designed to move the platform to location and install it as a unit with deck section and starting piles in place.

The design was developed by Christenson & Graham, Inc., marine consultants of Pasadena, Tex. First unit is being built by Todd Shipyards Corp. for Coastal-Marine Drilling & Construction Corp., Houston. Delivery is due about January 1958.

In effect, the launching device will be two barges joined by heavy hinges. Carefully controlled ballast, together with natural buoyancy, will help tip the platform into a vertical position and let it sink slowly to the floor of the gulf.

The so-called surface barge will be 130 ft. long and 56 ft. wide. The submersible barge will be of equal length but only 32 ft. wide. They will be connected by four hinges which will permit the smaller barge to tilt a platform upright into the gulf.

Coastal-Marine claims the barges can be used for erecting 6 or 8-pile structures in water depths of 30 to 120 ft. Although they are designed

our present heat engine for automotive transportation.

To fuel present heat engines or the possible "breakthrough" types he visualizes, Campbell insisted hydrocarbons offered the best bet. Supplies from petroleum, tar sands, coal and lignite appear adequate for may years to come. But as energy requirements rise the industry has an economic responsibility to burn them as efficiently as possible.

Whatever the technical trends, Campbell stressed the need for getting greater efficiency and economy from automotive engines in the future. The stakes are great today, and tomorrow they will become vastly greater, Presently, the cars, trucks, and buses on U. S. highways have a capacity of more than 8 billion horsepower—50 times that of all the central electric-generating stations in the nation. A 6 per cent gain in efficiency could save about $1 billion a year, equal to the total U. S. electric-utility fuel bill.

Athabasca Plant Given Boost

CALGARY.—An early start on construction of a processing plant in the Athabasca tar sand area of northern Alberta was indicated here last week with the disclosure that a newly formed company is ready to apply for a permit to build a 250-mile pipeline to Edmonton.

Bituminous Oil Pipeline Co. of Calgary will make the application—a key step in tapping the tar sands, believed to be the largest oil reservoir on earth.

Bituminous is a wholly owned subsidiary of Royalite Oil Co., which plans a $50-million development program to produce oil from the sands.

Royalite officials made no immediate comment on the pipeline permit. The company has kept a tight lip on developments in the oil sands since making an announcement last January that a centrifugal method—the Coulson process—has proved successful and would be used in the field. Royalite announced in January it would build a 20,000-bbl. processing plant in the Fort McMurray area.

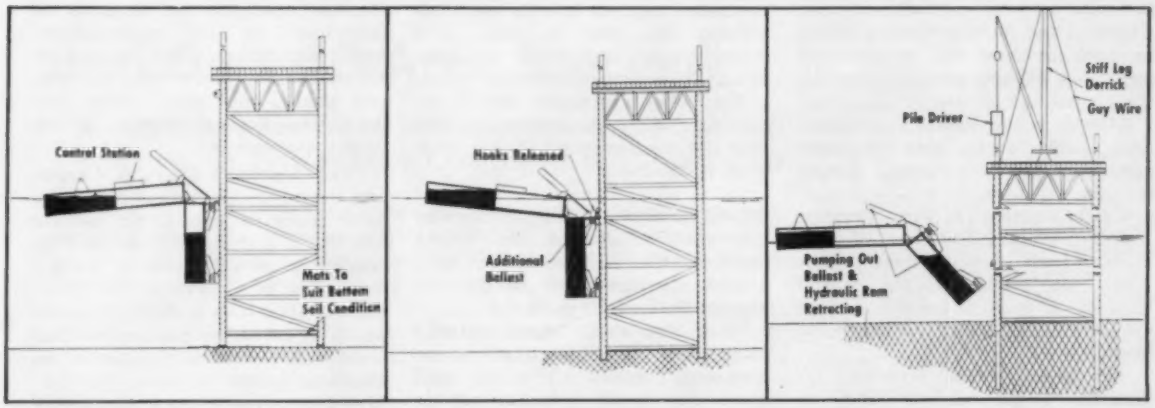
Oil reserves of the sands have been estimated at from 100 billion to 300 billion barrels.

An official of the Alberta Department of Mines and Minerals indicated the provincial government would not object to the proposed pipeline and that the company would have no trouble getting a permit.

Construction of the pipeline probably will not be hurried, however. At least 2 years would be required to complete the processing plant—and the pipeline would be of no value until the plant is built.

The Bituminous firm was incorporated in September. All of its officers also are officers of Royalite.

for Installing Drilling Platforms Offshore



Eases load to gulf floor . . . **Platform is released . . .** **And barge pulls away.**

primarily for small platforms used with drilling tenders, they also may be used with production platforms or larger drilling structures erected in sections.

On the deck of the surface barge four hydraulic rams, each having a capacity of 130 tons, will start the platform on its 90° rotation. As the platform reaches the halfway point the rams will restrain it to prevent a sudden drop.

Since temporary plates will cover the bottom of the legs, buoyancy of the platform itself also will help control its descent. These plates would be driven out later. A system of check valves has been incorporated into the design to prevent abrupt loss of pressure on the rams in event of a hydraulic line failure.

Ballast in outer compartments of the surface barge will tip this part of the vessel slightly to give an immediate clearance of about 2 or 3 ft. between it and the deck end of the platform. This is to prevent pounding of the platform against the barge.

After the platform is turned upright it may be unhooked from the barge by further ballasting to lower the launching section about 12 in. After erection of the platform, piling may be driven through its legs either with the use of a drilling tender or with a guy derrick which is attached to the drilling platform before leaving the shipyard.

Developers of the launching barge claim it can be used in reverse to remove a platform from an abandoned well.

The design has been tested with a scale model of a barge and platform. It also was checked for possible flaws by personnel in Texas A. & M.'s oceanography and civil engineering departments before construction began.

Howard S. Cole, Jr., Houston, is president of Coastal-Marine. The company now operates one shallow-water drilling barge and has just commissioned a drilling tender and a cargo vessel to add to its offshore fleet.

Automation Layoffs Alarm Unionists

Knight of O.C.A.W. sees two possible solutions:

. . . Shorter work week in standby clauses of oil, chemical contracts

. . . Extension of severance-pay plan started by Indiana Standard

DENVER.—President O. A. Knight last week put the 16 district directors of the international Oil, Chemical and Atomic Workers Union to work checking the prospects of layoffs in oil and chemical processing plants.

"There is considerable evidence that sizable layoffs may be forthcoming in the near future," Knight told the directors.

Knight declared his alarm stemmed from two sources: The threat of automation from new equipment now going into plants and the general softening of business conditions. Both are contributing dangers to unemployment.

The union leader, however, explained, "I am not yet ready to recommend that this union embark on a program of negotiations for a shorter week. This problem is too complicated to solve hastily.

"We should take a good look—and our employers should take a good look—at the idea of negotiating standby clauses in our contracts which would provide for reduction in hours as an alternative to layoffs, if and when layoffs are threatened in any given plant or operation."

What's strategy? . . . All this talk of a shorter work week left the union's 1958 strategy in the oil industry up in the air.

Knight instructed the 16 district directors to report their findings at a meeting of the union's advisory board in Denver next January.

Scheduling this meeting indicates that the union's bargaining policy committee may not hold its usual fall meeting this year to map 1958 strategy. The committee sets the union's contract improvement goals.

The policy committee now is expected to delay its conference until after the question of the shorter work week is decided.

Painful on men . . . Knight conceded that statistics indicate the United States and Canada probably will have a labor shortage rather than a surplus for the next 10 years.

"But," he said, "these statistics refer to the over-all situation and the long-range outlook. That is small consolation to the individual worker who loses his job because of the rapidly changing nature of equipment and methods in chemical plants, oil refineries, pipe lines and production fields.

"The most disturbing feature is that the installation of new methods and equipment can have its most painful effect on men in or near middle age, in roughly the 45 to 65 age bracket. They are least able to find a new job if laid off and are sometimes least able to change from their old jobs to the new methods.

"This union has never fought automation, although there has been considerable pressure to do so. Industry should realize this. Industry should in turn fulfill its responsibilities by meeting us halfway in solving the problem of taking care of these people displaced by automation.

"We have a duty to reduce to the absolute minimum the hardship to individuals of the readjustments which are taking place because of automation. By 'we' I mean the general public, this labor union, and the oil and chemical companies which employ our members.

"The United States and Canada and the oil and chemical companies have resources enough to provide jobs for everybody and are wealthy enough to provide security for the men who have devoted the prime years of their lives to their companies and who are in no position to jump from job to job when displaced by an electronic gadget.

"Unless industry can come up with a better plan, the shorter work week may be necessary to solve this problem."

The severance pay . . . The union president also urged oil and chemical companies to give serious consideration to two other ideas:

. . . Expanded in-plant job training programs to equip workers for new jobs.

. . . Increased severance pay or early pensions to cushion the hardships for those who are laid off.

The O.C.A.W. is contending that additional layoffs "are strongly hinted" in Standard Oil Co. (Ind.) by a new severance-pay plan recently announced by the firm.

The union, however, reports the

new plan "appears good if it does not abridge seniority."

The Indiana Standard severance-pay program is based on both length of company service and the age of the laid-off employe.

The company-service portion of the plan amounts to 75 per cent of a week's base pay for each year of employment after the first 2 years. This would apply to workers up to and including 57 years of age. At age 58, this allowance would start declining at the rate of 1/84th per month until reaching zero at the normal retirement age of 65.

That portion of the plan based on age would begin when an employe reaches 51 and would amount to approximately $57 per month up to a maximum of $4,800 at age 58. Then the age allowance would start declining at the rate of approximately $57 per month down to zero at age 65.

Who gets pay . . . Indiana Standard said the severance pay would go to any salaried or hourly-paid worker permanently terminated because of elimination of jobs, consolidations of departments or divisions, mergers, abandonment of plants, or technological changes.

"The amount of money the severance plan would pay is at best a poor substitute for continued employment, for a year and a half's income would be more than the maximum available under the formula," O.C.A.W. asserted.

"Still this is better than the 2 weeks severance pay many workers get when laid off. The laid-off man needs a stronger bridge between a regular pay check which stops too early and a pension check which does not start until age 65, but the bridge provided for Standard's severance plan certainly is better than none at all.

"Therefore we say to Standard of Indiana, provided its new severance plan in no way abridges seniority, 'Congratulatitons on a good thing'."

Only a few of O.C.A.W.'s 105,000 members in the oil industry are employed by Indiana Standard. However, the union claims "a considerable number" of members employed by American Oil Co. and other subsidiary companies.

Bisti Gets 40-Acre Spacing

● Operators now faced with an expensive infill drilling program ask New Mexico Commission for a rehearing

SANTA FE, N. M.—At least eight companies asked for rehearing after the New Mexico Oil Conservation Commission ordered 40-acre spacing for Bisti field.

Sunray Mid-Continent Oil Co., one of the principal developers at Bisti, said the commission will hear the new applications for 80-acre spacing December 18. Sunray said new evidence supporting wider spacing will be given.

In setting up 40-acre spacing, the commission rejected an earlier application by Sunray for temporary 80-acre spacing on a 1-year trial basis (OGJ, Sept. 30, p. 59). This pattern was opposed by Shell Oil Co. and Gulf Oil Corp., who want 40-acre spacing.

Sunray said that if 40-acre spacing is the pattern, it will mean infill drilling for much of the field, which has about 150 wells. Sunray testified in September that about 10,000 acres are already developed on an 80-acre basis.

Conflicting testimony . . . Sunray considers Bisti a solution gas-drive field, producing from five sand members of the lower Gallup formation at about 4,800-5,000 ft. The company believes the Gallup formation is continuous throughout the area.

On the other hand, Shell contends the permeable sands at Bisti are irregular and not continuous, and that the field does not have a gas cap.

Shell testified that "if it is not drilled on denser spacing pattern, much of the recoverable oil will be left in the ground." But Sunray countered that 40-acre spacing would be only a break-even proposition financially.

Sunray, which is operator of a miscible-phase pilot project at Bisti, said that close spacing would hamper ultimate recovery, while Shell believes that because of the irregularities of the reservoir, efficient sweepout could not be achieved on wide spacing.

The other operators which have filed applications for rehearing include British-American Oil Producing Co., Magnolia Petroleum Co., Lion Oil Co., Amerada Petroleum Corp., Sinclair Oil & Gas Co., Phillips Petroleum Co., and The Texas Co. All want 80-acre spacing.

—— *Industry* briefs

Producing Properties, Inc., Dallas, has acquired new interest in 61 wells in Texas. This includes a 17½ per cent interest in 13 oil wells in the Deckers Prairie area of Harris and Montgomery counties. The properties, formerly owned by Raymond D. Reynolds, Houston, were sold for $245,000. In Cooke County, the company acquired a 45 per cent interest under 48 wells in Gatewood field. Total purchase price was $48,000.

Canadian Husky Oil, Ltd., plans to buy all assets of Liberal Petroleums, Ltd. The purchase includes a 15⅓ per cent net interest in South Sturgeon Lake field, Alberta; varying interests in 364,000 gross acres in British Columbia, Alberta, and Saskatchewan; and four drilling rigs.

The deal, subject to approval by Liberal stockholders, involves distribution of one share of Canadian Husky common stock for eight shares of Liberal stock. Canadian Husky is active in exploration, production, refining, and marketing in western Canada.

Offshore drilling along the Atlantic seaboard within the next 10 to 20 years was predicted by Meredith E. Johnson, New Jersey state geologist, at the annual meeting of the Geological Society of America last week.

Johnson said an offshore field could run from Cape Cod, Mass., to Florida and as far out as the 30-mile Continental Shelf. He believes that conditions similar to those on the gulf and California coasts prevail along the eastern seaboard.

Evidence of the presence of hydrocarbons was found in a well drilled recently at West Cape May, N. J., and in another well drilled at Atlantic City a year ago. Both were presumably drilled for water. West Cape May is on the extreme southern tip of New Jersey on the Delaware Bay side.

Southern Counties Gas Co. will build a $2,250,000, 13-story office building in downtown Los Angeles on the southeast corner of Flower and Eighth Streets. It will adjoin the existing office building of its companion company, Southern California Gas Co. Pacific Lighting Corp., parent company of both gas utilities, will occupy offices in the new building as will a third subsidiary, Pacific Lighting Gas Supply Co.

Flood Proration Argued

● Humble leads fight against allowable exemptions for New Mexico project. Graridge says low production rate will cause loss of recoverable reserves.

SANTA FE, N. M.—The industry has rekindled an old feud over how much favored allowable treatment, if any, a water flood should get.

Those favoring capacity allowables — led primarily by independents—won out in a running struggle before the Texas Railroad Commission 2 years ago.

Now, roughly the same opponents are fighting out the issue before the New Mexico Oil Conservation Commission. A decision is expected soon.

Unlike Texas, water flooding in New Mexico is something new. While there are a few floods in operation now, none of the operators has asked the commission for allowable exemptions.

The controversial application was filed by Graridge Corp., a producing company owned by the Street interests of Graham, Tex. Graridge is seeking permit for a 720-acre pilot flood in Caprock Queen sand pool in Chaves and Lea counties, southeastern New Mexico.

Since this is the first request for a capacity flood allowable in New Mexico, both sides brought their biggest guns when hearings began late last month.

Both sides are aware that this first case may set a precedent for commission action on similar requests in the future.

The Graridge application is supported by Gulf Oil Corp., Sunray Mid-Continent Oil Co., General American Oil Co. of Texas, The Texas Co., Union Oil Co. of California, Forest Oil Corp., Ambassador Oil Corp., Great Western Drilling Co., and Sinclair Oil & Gas Co.

Companies opposing it are Humble Oil & Refining Co. (which led the fight against capacity allowables for floods in Texas), Sun Oil Co., and Cities Service Oil Co.

Professors testify . . . Humble's Dr. Claude Hocott, director of the production research department, pointed out to the commission that Humble is the third largest producer of waterflood oil in Texas.

Experience and exhaustive laboratory research has convinced Humble that secondary-recovery floods deserve no special treatment, Hocott told the commission.

Backing Humble's position were professors of petroleum engineering from three oil-state universities: George H. Fancher of the University of Texas; Frank W. Cole, University of Oklahoma; and C. F. Weinaug, Kansas University.

Cole told the commission that "the rate of production of a water flood can be curtailed without loss of oil reserves," and Weinaug testified that the rate of production isn't important to ultimate recovery.

Field histories . . . Backers of the application argued that Humble's testimony and that of the professors was "theoretical and based only on laboratory work."

They countered with half a dozen field case histories which they said prove without doubt that low rates of water injection and oil production in a secondary-recovery flood cause loss of recoverable reserves and thus are wasteful.

The case histories also prove, they contended, that the damage is done once a low injection-production rate is adopted. The rate cannot be stepped up, and not as much oil can be recovered.

Heavy emphasis was laid on such a case reported by Sinclair. F. F. Wright, engineer with Sinclair at Tulsa, said his firm launched a flood on a lease in Browning field, Greenwood County, Kansas, in 1949.

Injection into the Bartlesville sand was started at a low rate because of a lack of input water. The low rate was continued for 6 years, and oil production increased very little.

Later, the company found an adequate water supply. Water was injected at high rates in surrounding leases. Heavy increases in oil production came quickly.

Sinclair also boosted the injection rate at the first lease. The result was very heavy water production but an insignificant increase in oil output, Wright said.

Graridge project . . . The project causing the turmoil is a five-spot pilot flood in the 3,000-ft. Queen sand in the northeast end of Caprock field. This is the oldest part of the pool.

Graridge operates 65 wells on the lease, with a total November allowable of 327 bbl. daily. Only one well is capable of making the state-wide 37-bbl. daily allowable at that depth.

E. Bruce Street, one of the owners of Graridge, said the wells are producing an average of about 2½ bbl. per day.

Caprock field itself has about 600 wells on 6,000 acres with a total allowable of 13,934 bbl. daily. This includes 364 marginal wells.

It was estimated at the hearing that if the entire field were flooded, it would produce 19,000 bbl. daily at its peak—or about 8 per cent of New Mexico's entire production.

Important issue . . . More and more state regulatory bodies are confronted with the same issue being debated at Santa Fe.

Water-flood production will inevitably play a larger role in the domestic industry. The percentage of waterflood oil to total oil produced is growing each year. And as new fields become harder to find, the percentage will continue to rise.

Humble thinks the percentage has already grown to the point where new wells and fields, found at increasingly greater costs, are penalized.

The Interstate Oil Compact Commission has tried hard since 1953 to come up with an answer to the question so that it will be able to advise state agencies on how much incentive to give secondary-recovery floods.

Evidence presented to the Compact has been just as contradictory as the evidence before the New Mexico commission. The Compact hasn't come up with the answer yet.

New Buying Policy

may result from criticism of military oil purchases in Caribbean

WASHINGTON. — New policies limiting military oil purchases from foreign refiners are being studied in the Defense Department.

The department has been under sharp attack for making heavy purchases of jet fuel from Caribbean refiners at a time when another branch of the Government is trying to limit imports.

Domestic producers and refiners who have protested the exemption from the Buy-American Act permitting such buying have been assured that the matter is being actively considered.

The jet fuel bought in the Caribbean represented more than 20 per

cent of the total purchased. Importers seeking increased quotas attacked this as nullifying the intent of the import-control program.

As a result of criticism, the department is expected to put a limit on the Military Petroleum Supply Agency to keep foreign contracts in line with the 9.6 per cent ratio of imports to demand imposed on crude importers.

Projects Approved

FPC tacks condition on T.G.T. expansion plans

WASHINGTON.—A $130-million expansion of Tennessee Gas Transmission Co.'s system was approved last week by the Federal Power Commission.

The expansion includes 900 miles of pipeline and 66,990 compressor horsepower. The increase of 287,462 M.c.f. which the new facilities will give is part of T.G.T.'s over-all project for 1,072 miles of new line and 120,990 compressor horsepower. The full package calls for an increase of 456,408 M.c.f. daily at a cost of $175 million.

The FPC, however, approved the program on one condition: The company must show next month that the facilities will be used only to serve existing customers.

The FPC's condition was imposed because part of Tennessee's added capacity will be used to supply Midwestern Gas Transmission Co.'s proposed system in the Midwest. The application was one of 20 by nine competing pipeline companies on which consolidated hearings are being held.

Tennessee plans to build a 556-mile, 30-in. line from the Mississippi Delta area south of New Orleans to Portland, Tenn. Portions of the main line between Portland and New York will be looped with 340 miles of 24, 26, and 30-in. pipe.

The company is completing a 107-mile gathering and transmission system to tap Gulf of Mexico reserves which will supply a major portion of its expansion program.

Tennessee would deliver 200,000 M.c.f. per day at Portland to the affiliated Midwestern firm and import a like amount from Trans-Canada Pipe Lines, Ltd., at Emerson, Man., under the program being considered. The opposing Peoples, Northern Natural, and American Natural groups have tried to make a deal. They want to get 25 per cent interest each in Midwestern to compromise the fight over the Midwest market. But Tennessee has thus far declined to relinquish control of Midwestern.

watching WASHINGTON

. . . with Bertram F. Linz

Federal figures to get scrutiny

STATISTICAL WORK of the Government will get a going-over from Congress next year.

There is growing skepticism in industry about the value of the one report government economists lean on most heavily—that of gross national product.

The GNP consists of the value of the goods, services, and everything else that goes to make up national income. The big complaint is that it tries to show the health of the country in dollars, with no adjustment for price inflation.

The figures can be misleading because of this. They tend to lull industry into the belief that everything's swell because they overstate the growth of the economy. The most recent report, for instance, probably reflects increased prices more than increased output.

A report adjusted for price shifts is needed, economists say. This would make it possible to measure changes in productivity by comparing actual output to man-hour data.

Congress will be asked to look into the matter next year. Business interests will work for increased funds and better figures. One of the changes to be asked will call for quarterly diagnoses of the national health in terms of constant dollars.

Is a tanker too old at 20?

THE IDEA that a tanker or cargo ship is obsolete when it becomes 20 years old is challenged in some government circles.

There is no aim to detract from the importance of shipping in the national defense. But it is felt that less emphasis could be placed on age as a criterion for replacement of ships.

If this view prevails it is likely that no sizable funds will be given the Maritime Administration for trade-and-build programs next year.

A new look at our merchant marine from this angle might influence Congress against big new ship-replacement programs. That would be fine with both Congress and the administration, as an economy move.

Defense spending will increase next year as the U. S. strives to regain first place in guided missiles. But the administration is anxious to keep the over-all budget below $72 billon, if possible. That means that other spending will have to be cut.

At the same time, it is pointed out, the tanker-building fervor generated by the Suez crisis has cooled under the icy wind of less demand for tonnage. With eight new or converted tankers delivered since last July 1 and 79 contracted for, some think it might be time to take another look at the ship program.

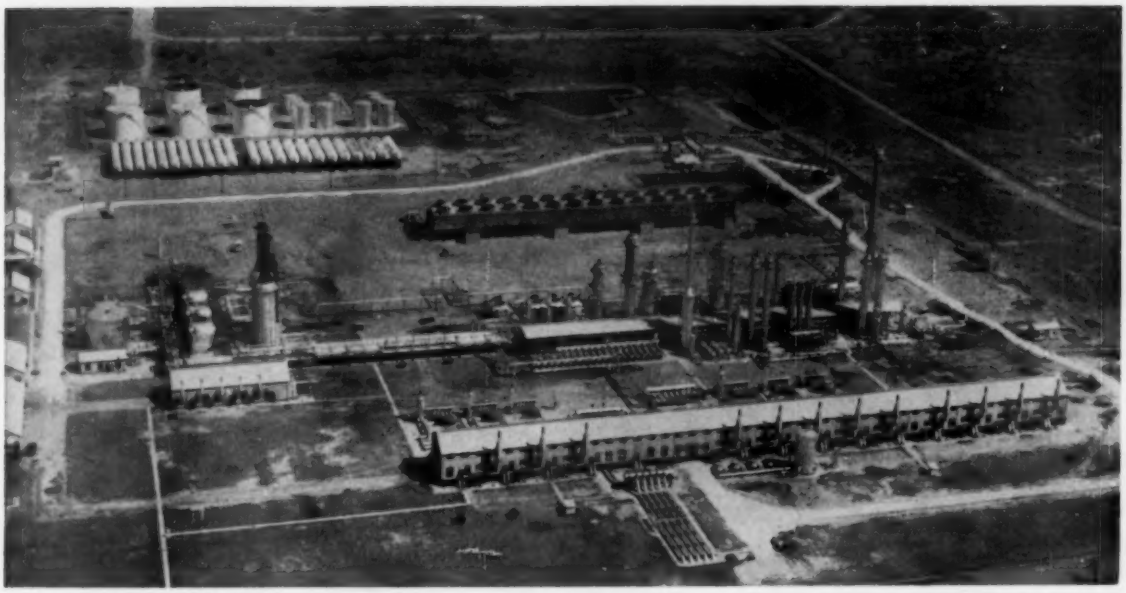
Estes eying "good faith" case

THE SUPREME COURT may decide again before the end of the year whether it is legal to cut prices to meet competition.

But it's 50-50 whether the court's decision will settle the issue in the "Detroit case." There, Standard Oil Co. (Ind.) is charged with discrimination in cutting prices to meet competition in good faith.

If the court stands by its 1951 verdict that such cuts are legal, there will be a new drive in Congress next year for the Kefauver bill to outlaw them. Under that bill, which once passed the House by a 393-3 vote, if a refiner cut his price to one customer he would have to cut it for all buyers, not only locally but in all areas.

So far, industry opposition has blocked the bill in the Senate. But Sen. Estes Kefauver is not discouraged. If the court doesn't knock out the good faith defense, he will try to do it.



Processing and cycling may be boosted at this Premont, Tex., gas plant because . . .

Unit Plan to Give Seeligson New Zip

Texas Railroad Commission will rule soon on a complicated unitization plan for 58 reservoirs in the South Texas field. Injection and cycling program is expected to increase recovery by 60 million barrels starting in March.

DALLAS.—One of the most complex unitization and pressure-maintenance projects yet attempted seemed near realization last week for big, multireservoir Seeligson field in South Texas.

The mammoth program calls for simultaneous maintenance or cycling operations in 18 separate Seeligson reservoirs.

The operation is expected to increase oil recovery from the 14,240-acre unit by more than 60,000,000 bbl.

Initial hearings before the Texas Railroad Commission on the unit plans, drawn up by Sun Oil Co. as proposed unit operator, were held October 25 and 28. Final information was put in the record November 7.

The application actually proposes to unitize 58 Frio reservoirs ranging downward from 4,400 ft. However, only 18 of these are felt large enough to support economic fluid-injection programs. These have 97.9 per cent of the recoverable reserves of oil and 67.2 per cent of the recoverable gas reserves within the unit area and depth.

Of the remainder, 10 have too little oil to justify pressure maintenance and too little gas reserves for cycling, 14 are small oil zones presently performing satisfactorily, and 16 are associated gas zones too small to cycle.

The unit will take in the entire field except for two leases at the northeast end—Humble Oil & Refining Co.'s big King Ranch Seeligson lease and the Wilson-Rawlinson lease.

Generally, the huge program provides for:

. . . **Injecting gas** into the caps of the major oil reservoirs to maintain pressure and control cap movement.

. . . **Injecting water** into the aquifer of some of the 18 pools.

. . . **Cycling** all important gas caps to prevent retrograde condensation and resulting hydrocarbon loss, and extending cycling through the thin oil columns of some reservoirs to increase recovery there.

Old unit obsolete . . . Actually, the Jim Wells County area of Seeligson—the acreage proposed for the program—already is unitized. But it is a gas unit. It was formed in 1947 to avert a state-threatened shutdown because of large-scale gas flaring.

The effect of having only gas rights unitized, however, led to competition in the associated reservoirs between gas interests and oil interests. This has made it difficult, if not impossible, to set up effective programs to use and sell gas reserves without serious damage to oil recoveries.

The new unit, which will include all oil, dry gas, and casing-head gas rights, will remove these competitive drawbacks to efficient production of all fluids.

Along with this are the normal reasons for unit operation and pressure maintenance. Reservoir pressures in the larger oil zones are declining and gas-oil ratios climbing. Gas and water interfaces also have been advancing irregularly in most of the zones.

The other 40 . . . Why were 40 other producing pools included in the unit when there are no plans to cycle or maintain pressure in them?

Three reasons are given for the big unit:

. . . **There are many wells** dually completed between zones which will

see injection and others which will not. Unless both are unitized, the operation might be so complex as to defeat the injection programs.

. . . Some of the 40 pools will furnish makeup gas for fluid injection in the primary 18.

. . . It is necessary to coordinate depletion of each zone so that the pressure differentials between reservoirs won't become great enough to break down the cement barriers between them.

Seeligson was discovered by Magnolia Petroleum Co.'s 7 Seeligson in December 1937. The well was completed in what is now known as Zone 22 and was located high on the anticline. Development was slow until 1941 when a well was completed well down on the flank of the structure in Zone 19-C. This kicked off an active drilling campaign, and development of all zones above 20-C4 was essentially complete by early 1950.

There now are about 670 active wells in the entire field. About 465 of these wells (with 637 completions) are in the unit area. Oil and gas accumulation is controlled by three major structural highs coupled with minor faulting, sand pinchouts, and variations in gas and oil contacts.

The 18 reservoirs which will be directly affected by the injection programs are Nos. 10, 13A-02, 13A-05, 14B, 16-D, 17-02, 17-05, 18A-05, 19B-03, 19C-04, 19D-01, 20A-03, 20A-05, 20B-03, 20C-02, 20C-13, 20C-15, and 20C-44.

Much to gain . . . What the operators stand to gain appears well worth the effort to unitize.

Sun estimates that it will take about $1,500,000 in capital investment and supplemental costs to get the injection programs going.

Part of this will go for hiking capacity of the existing gasoline plant to handle 90,000,000 cu. ft. of casinghead gas and 160,000,000 cu. ft. of cycle gas daily. The rest is allocated for installing the required extensive gas-handling system and the water-injection facilities.

In return, the operators anticipate producing added oil valued roughly at $200,000,000.

Participating in the program along with Sun are Sunray Mid-Continent Oil Co., Shell Oil Co., Sinclair Oil & Gas Co., Texas Gulf Producing Co., The Texas Co., Magnolia Petroleum Co., Republic Natural Gas Co., Renwar Oil Corp., and others.

Magnolia, under the agreement, will continue to operate the Seeligson gasoline plant as it has under the old unit.

Pipeline briefs

Cities Service Gas Co. will complete the addition of 3,600 hp. to its Blackwell, Okla., compressor station next week. J. E. Carlson, Inc., is handling the project. Cities Service will complete 77 miles of 30-in. in Kansas next month. The new line will replace dual 16-in. lines which will be reclaimed between its Welda station and the Verdigris River.

Northern Natural Gas Co. plans to build 28 miles of 30-in. loops in Kansas and Texas as part of an expansion to increase capacity 131,000 M.c.f. daily. The $3,025,000 project, now before the Federal Power Commission, would tap new gas sources in the Texas Panhandle, Oklahoma, and Kansas. Northern Natural contracted for new reserves at 15 to 16½ cents per M.c.f.

Transcontinental Pipe Line Corp. proposes 548 miles of new pipelines to increase deliveries from storage in Pennsylvania and expand system capacity by 175,000 M.c.f. per day next year.

The project, to start in February pending FPC approval, includes 202 miles of 36-in. and 132 miles of 30-in. loop along the main line plus 36,080 hp. in compression. Transco would lay 164 miles of 24-in. to underground-storage fields in Pennsylvania. To connect new gas supplies on the Texas and Louisiana Gulf Coast, 250 miles of 10 to 20-in. gathering lines will be laid. The projected 1959 program calls for 57 miles of 36-in. loop.

"On the Job . . . Pipelining" is the new name for the regular Journal feature formerly called "Pipeline Patrol." The new name is more expressive of the kind of information which goes into the feature—everyday suggestions that you can apply to your job in pipelining. Watch for "On the Job . . . Pipelining" in the Journal November 18, and alternating weeks after that.

Interprovincial Pipe Line Co. is operating the latest in a chain of 17 pumping stations on its Edmonton-to-Port Credit, Ont., crude line. The new station is located southeast of Sarnia, pumping crude to Port Credit and Clarkson, Ont., refineries through the new 20-in. extension from Sarnia. This segment of the line has capacity of 111,000 bbl. daily. Another pumping station would boost this to 185,000 bbl. daily.

Leonard Refineries, Inc., has let a contract for its 43-mile, 6-in. products line to Welded Construction Co. The line, to have capacity of 8,000 bbl. daily, will move products from Leonard's two Alma, Mich., refineries to Lansing, Mich. The construction schedule calls for completion next spring. A 100,000-bbl. terminal will be built at Lansing.

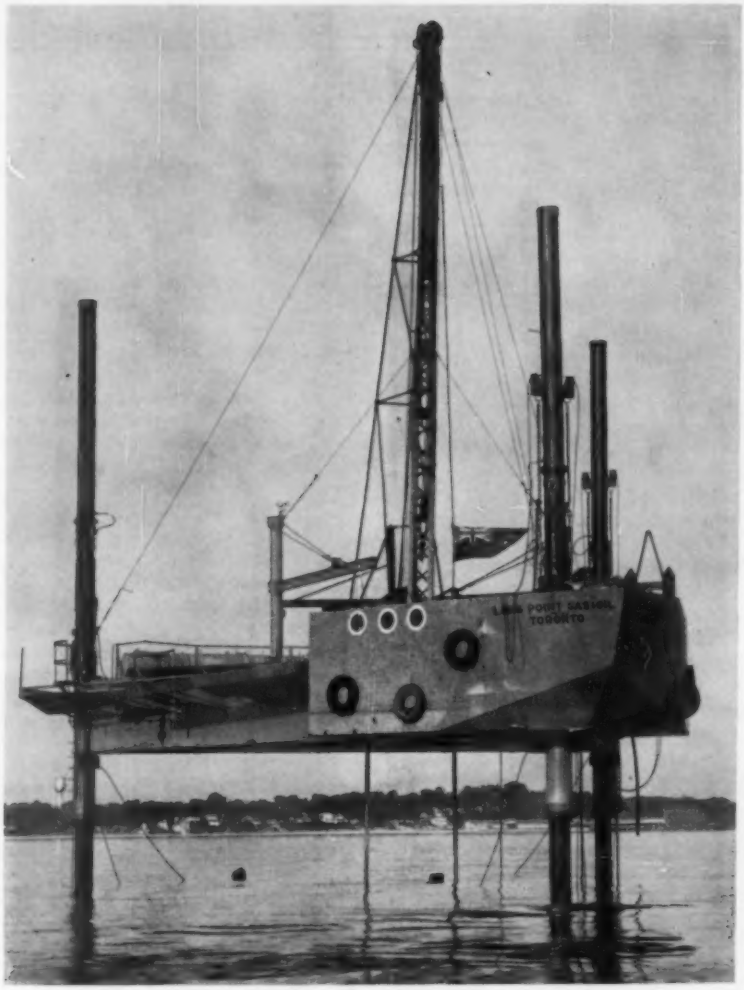
Cosden Petroleum Corp. will soon start supplying the Wichita Falls, Tex., area market with refined products through a 134-mile, 6-in. pipeline to be completed this week.

The line originates at Abilene, where it connects with Cosden's Big Spring, Hawley, and Colorado Springs refineries, through another pipeline. The line, contracted to Holder Construction Co., will be operated by Trust Pipe Line Co., subsidiary of Cosden. Capacity, with a 250-hp. pump station at Hawley, will be 8,000 bbl. daily. Company crews built the station. Condon will supply custom-refined products to other companies and market under its own name in the Wichita Falls area (OGJ, Apr. 22, p. 95).

Also for Pipeliners . . .

IN THE NEWS: Plans for pipeline to Edmonton give Athabasca tar-sand project a boost (p. 121) . . . FPC approves T.G.T. expansion projects with one reservation (p. 125) . . . Kerr-McGee is now negotiating to buy Texaco's gathering system in Oklahoma oil fields (p. 130) . . . Shell officials are talking about an international pipeline from Sahara fields to the Mediterranean (p. 132) . . . Murchison money is not behind big-inch line from Iran through Turkey (p. 134).

PLUS THESE TECHNICAL REPORTS: Two-phase pressure drop in inclined pipelines (p. 145) . . . Two-phase flow in gathering systems (p. 150) . . . Corrosion of oil-industry storage tanks (p. 153).



New tool for Lake Erie gas play. It's a . . .

Mobile Cable-Tool Platform

TORONTO. — The oil industry's first mobile platform for offshore cable-tool drilling soon will become a veteran of Lake Erie operations.

Long Point Gas & Oil, Ltd., last week spudded its second well in the lake with the unusual equipment. The first well was completed earlier this month.

The floating drilling platform is an equilateral triangle in shape. Each side is about 60 ft. It is towed into location by the company's work boat with its three legs about 40 ft. in the air.

On location the legs are lowered hydraulically to the lake bed. They lift the whole platform about 10 ft. above water at the rate of 1 ft. a minute. Maneuverability and design of the platform allow it to be towed, moved into position, and ready to drill within 2 hours.

The platform is designed to withstand winds up to 80 m.p.h. and wave action up to 20 m.p.h. Existing legs enable drilling in 25 ft. of water. For drilling in deeper water up to 45 ft. higher tensile legs can be substituted. The drilling barge weighs about 100,000 lb. and is constructed with 12 separate watertight steel compartments.

Long Point Gas & Oil has the biggest acreage spread in the booming Lake Erie gas play. Its spread covers 256 sq. miles in the eastern end of the lake opposite long established gas fields on the mainland.

Geologists believe that Ohio's great belt of Clinton Silurian gas fields extend under waters of Lake Erie. These fields extend right up to the lake's southern shore. It's also from the same Silurian sands that gas has been produced in Niagara Peninsula field just inland from Long Point's acreage.

The average onshore well has produced 300,000 cu. ft. per well per day. The first Long Point well was bottomed in the White Medina at 944 ft. It flowed at the rate of 30,000 cu. ft. daily. Company geologists reported information obtained from the structures was encouraging and indicated the well was off structure. This information led to locating the second well ¼ mile south.

Taxes Up in '57

Oil may be nation's biggest single tax revenue source

WASHINGTON.—The oil industry may well be the greatest single source of taxes to support the federal Government.

The four excise taxes alone accounted for 2 per cent of the $80.1 billion collected by the Treasury in fiscal 1957.

Corporation and individual income taxes, employment taxes and other levies collected all along the line from scout to filling-station worker substantially increased the industry's contribution.

The excise taxes—on gasoline, lubricating oils, pipeline movement and diesel fuel—topped the $1.5 billion mark in 1957 for the first time. Most of the $443 million increase which brought revenue from $1,165 million in fiscal 1956 to $1,608 million last year was due to the 1-cent hike in gasoline and diesel fuel taxes to pay for the new road program, however.

Gasoline taxes amounted to $1,458 million last year against $1,030 million in 1956. Allowing for the 50 per cent hike in the rate, this would indicate that consumption fell off slightly.

Lubricating and cutting oil sales also dropped. The $73.6 million collected was more than $1 million less than the $74.6 million received in 1956.

Receipts from pipeline transportation and diesel fuel both showed increases. The former rose to $37.1 million from $35.6 million and the latter to $39.4 million from $24.4 million.

Teapot Dome to Be Drilled

WASHINGTON.—The Navy will move back into the Teapot Dome reserve next year with a series of shallow wells along the eastern border. The Wyoming oil reserve, which gave its name to one of the big scan-

dals of the Harding administration 30 years ago, has been dormant for years. But the Navy found out recently that some small operators are working up against the border, cracking the tight Shannon sand which holds reserves estimated at 10 million barrels. The reserve covers 9,480 acres.

The department plans to reassign $50,000 of its present fund to start drilling. The wells will be less than 1,000 ft. deep. They will be sunk along a 4-mile strip across from where private operations are believed to be draining the Government's oil.

If sufficient oil can be produced to make it worth while, the program may be extended.

The Navy does not plan to do the drilling. It will make an operating agreement with some producer on the basis of competitive bids. The Navy will say how much oil is to be produced, and the Government's share will be sold at auction.

Proration Reduced

Gulf, Rock Island buying more crude in Southwest

PIPELINE PRORATION was eased in four southwestern states last week when two major purchasers announced they are increasing their crude buying.

Rock Island Oil & Refining Co. resumed taking its full allowable in Oklahoma, and Gulf Oil Corp. reduced proration in Oklahoma, Texas, Louisiana, and New Mexico.

Rock Island said it hopes eventually to make up underage which has accumulated since proration began in July. The proration amounted to 15 per cent in July and August, compared with May runs, and was lessened to about 5 per cent in October.

The company said it was able to resume full buying because of a "small seasonal improvement in the market" and because operations have resumed in strikebound refineries. Purchases by Rock Island in November will amount to about 57,000 bbl. daily.

Gulf announced that November buying has been increased in Texas from a 10-day to an 11-day pattern and that proration has been cut by approximately 50 per cent in Oklahoma, Louisiana, and New Mexico.

Gulf has been cited for contempt of the Oklahoma Corporation Commission for failing to take its full allowable in August without obtaining permission of the commission. Hearing is set for November 27 and 29. The company is expected to appeal any adverse ruling to the courts.

Processing briefs

General Chemical Division of Allied Chemical & Dye Corp. will build a new sulfuric acid plant at Anacortes, Wash. Located on a 16-acre site near the Shell and Texaco refineries, the plant will take hydrogen sulfide and spent alkylation acid from both refineries.

General Chemical is nearing completion on another plant adjacent to Esso's Bayway refinery, Linden, N. J. At this plant, hydrogen sulfide from Esso will be converted to elemental sulfur. The plant will have a capacity of about 60 tons per day. Spent alkylation acid from Esso and other nearby refineries will also be reconstituted in the new Linden installation.

Hercules Powder Co. will double the capacity of its urea plant at Hercules, Calif. By next autumn, the plant will be able to turn out 20,000 tons a year, based on ammonia and carbon dioxide, both available at the existing installation.

Monsanto Chemical Co. is bringing its new adipic acid plant on stream at Luling, La. The project represents a major expansion for the intermediate used in making nylon, resins, plastics, and synthetic lubricants.

John Ben Sheppard, secretary-treasurer of Odessa Natural Gasoline Co. and former attorney general of Texas, will be a principal speaker at the Panhandle Plains regional meeting of the Natural Gasoline Association of America meeting in Amarillo November 22. The program also includes a panel discussion of plant problems and several technical papers.

Refiners of the United States have cut their Alberta crude-oil nominations by nearly 30 per cent for November and thus contributed to the downhill demand in the province.

Nominations for November from all refiners dropped by 30,530 bbl. daily from October to a total of 289,618 bbl. The U. S. refiners asked for 77,010 bbl., compared with 107,153 in October.

In the U. S., Washington refiners nominated 58,761 bbl. for November, Wisconsin 5,000, Minnesota 8,333, Michigan 4,666, and Montana 250.

A new low-cost method for recovering fresh water from sea water is claimed by Maxim Silencer Co., Hartford, Conn. Maxim says its new process will deliver water at about 20 cents per thousand gallons. Old hands at this sort of thing, the company spokesmen say their method includes an important improvement in removing salt scale from evaporation equipment.

Loffland-Allison Co. plans to have its new natural-gasoline plant south of Fort Morgan, Colo, in operation by January 1. Green Brothers of Fort Morgan started construction of the $400,000 plant in September. Ten shut-in gas wells in the Fort Morgan field will be put on production when the plant goes on stream. The plant will have a capacity of 8 million cubic feet daily.

California Oil Co. has awarded contract to H. K. Ferguson Co. for construction of a 10,000-bbl. U.O.P. Unifining-Platforming unit at Perth Amboy, N. J. Construction will start next spring with completion in 1959.

A U.O.P. Platforming unit — the sixth of 11 licensed to Japanese petroleum refiners—has gone on stream at the Maruzen Oil Co., Ltd., refinery at Matsuyama, Japan. The Platformer has a capacity of 3,000 bbl. per day. Crude capacity at the refinery also has been increased and erection started on a 1,500-bbl.-per-day Udex unit.

Also for Refiners . . .

IN THE NEWS: Oil men gather today in Chicago for 3-day sessions of A.P.I. (p. 113) . . . Warren increases propane price by half cent, citing production dip and demand jump as the reason (p. 118) . . . Rising West Coast imports prompt review of control policy for that region (p. 119) . . . Automotive engineers told today's auto engines aren't efficiently using all the energy available in high-octane gasoline (p. 120) . . . New pipeline may mean early start on Athabasca processing plant (p. 121) . . . Layoffs due to automation in oil plants are worrying union leaders (p. 122) . . . Defense Department is studying new military buying policy (p. 124) . . . Stanvac puts Southeast Asia's first cat cracker on stream (p. 134).

PLUS THESE TECHNICAL REPORTS: Corrosion of oil-industry storage tanks (p. 153) . . . What's happening to butadiene? (p. 166) . . . Propane chiller cuts alky unit acid losses (p. 172).

Seismograph's Gerald Westby points to spots where . . .

Strat Traps Are Being Mapped

TULSA.—How to find strat traps has always puzzled geophysicists, but new seismic methods are paving the way to successful mapping techniques.

Gerald H. Westby, president of Seismograph Service Corp., says that by combining the latest geophysical methods, the oil finder is now able to map these hard-to-find oil fields.

Westby told delegates to the recent Mid-Continent regional meeting of the American Association of Petroleum Geologists that strat-trap mapping has gone past the theoretical stage.

He cited examples in both Oklahoma and the Rocky Mountains where maps, based on seismic data, uncovered new production. But although results have been encouraging, he pointed out that field mapping is still in an early stage of development.

The following devices have contributed to successful strat-trap mapping:

. . . Continuous velocity logging, a relatively new technique which gives the geophysicist a detailed analysis of the subsurface velocity. The tool is lowered into a well bore and a velocity survey is made in a matter of minutes.

. . . Synthetic reflection records. These can be made from the continuous velocity log and are considered as type records for a given area.

Field records can be compared to the synthetic records and interpreted in the light of both geophysics and stratigraphy. With this approach it is possible to identify individual sand lenses and to map their distribution.

. . . Variable density cross-sections through the earth's surface along a geophysical traverse. Field data is processed through magnetic recording instruments and then passed through new electronic instruments.

The final result is a seismic section that shows the subsurface layer by layer. This gives a familiar "layered" picture of the subsurface to the geologist.

By combining these recent geophysical developments, Westby said, the oil finder has the theoretical approach for mapping strat traps.

As an example of how such mapping has resulted in finding new production, Westby cited a case in northern Oklahoma where a seismic survey mapped a pinchout of the Misener sand on the flanks of a known oil field. Subsequent drilling found oil production in this zone, although the sand was absent on the crest of the structure.

Humble Expanding Pipeline

HOUSTON. — Humble Pipe Line Co. announced plans last week for expansion of its crude-oil trunkline between the Texas Panhandle and the Gulf of Mexico.

The company will construct a 16-in. pipeline 90 miles long between Hawley, in Jones County, and Comyn, in Comanche County. Construction is expected to start next February.

The new segment will have a capacity of 99,000 bbl. a day.

Kermac Negotiates

. . . for Texaco's gathering system in Oklahoma fields

KERR-McGEE Oil Industries, Inc., which announced purchase of Gulf Oil Corp.'s gathering system in Oklahoma 2 weeks ago, is now negotiating to buy The Texas Co.'s gathering and feeder lines in the state.

If the deal goes through, Kerr-McGee will be acquiring more crude than it needs for its two refineries in Oklahoma at present and thus will become a crude seller.

The Texas Co., like Gulf, has been interested in disposing of its gathering system for months, while Kerr-McGee has become increasingly interested in obtaining a source of crude supply for its expanding Wynnewood and Cushing refineries. Kermac acquired Deep Rock Oil Corp. in 1955 and is expanding Deep Rock's retail outlets.

The company last week was described as "talking seriously" with Texas about the Oklahoma lines, which gather approximately 9,000 bbl. of oil per day. Texaco's trunk lines are not for sale, but the feeder lines to main trunks, along with the gathering system from wells, are factors in the proposed deal.

Most of the lines are in southern Oklahoma, where the Wynnewood refinery is located, and would fit well into Kermac's plans. The 1,100 miles of Gulf lines are located in northern and eastern Oklahoma, nearer the Cushing refinery.

The Gulf purchase, effective January 1, will double Kerr-McGee's present crude buying of about 21,000 bbl. daily. If the Texas deal goes through, the Oklahoma firm will have pipeline purchases of around 50,000 bbl. daily.

Ratable-Take Order Killed

BATON ROUGE. — Louisiana's first order requiring ratable take from an oil field has been withdrawn by Conservation Commissioner John B. Hussey.

The short-lived order, issued 2 months ago, attempted to force Sun Oil Co. to buy proportionately from all producers in University field (OGJ, Sept. 9, p. 56).

The order had been sought by T. G. Markley, Baton Rouge independent. He charged Sun had refused to buy his production of some 380 bbl. daily although it was buying from other operators in the field.

Iran Plans Leasing

. . . in Persian Gulf waters. Limits of the new offshore area are defined, but the western boundary line is still vague.

IRAN set the stage last week for a new and intensive hunt for oil under the waters of the Persian Gulf.

Iran will open to competitive bidding the Persian Gulf waters lying offshore parallel to about 285 miles of her western shoreline. National Iranian Oil Co., the government oil agency, says the region will be "open" after February 1.

The offshore area comprises the country's Petroleum District 1. It is the first region opened for bidding under the terms on Iran's new oil law. In describing this district last week, Abdollah Entezam, N.I.O.C. board chairman, was very specific in some respects and very vague in others.

It consists of "part of the Iranian territorial waters and Continental Shelf"—but only that part which lies west of 53 degrees, 30 minutes east longitude.

Entezam makes no effort at all to define the western limits of the new offshore petroleum district. The territorial claims to Persian Gulf waters have never been settled by the nations bordering the gulf.

Exceptions to the "open" territory are very specific. They include:

. . . **Waters** 3 miles out from the lowest tide line of the mainland.

. . . **Islands** of Shaikh Shuaib, Kharg, and Khargo and 3 miles of territorial waters surrounding each.

. . . **The 2,162-sq.-mile block** at the head of the Persian Gulf already granted to SIRIP, the joint Italian-Iranian company.

The waters 3 miles out from the lowest tide line along the mainland are included in the International Consortium area. The same is true of the three Persian Gulf islands named by Entezam.

The grant already made to the Iranian-Italian company lies within District 1, but it was excluded because of the commitments already made.

Application procedure . . . Interested companies or individuals have until February 1 to ask Entezam for a detailed questionnaire which they must fill in and return to N.I.O.C. This is aimed at establishing both the applicant's technical and financial abilities.

Once these two points have been established to the satisfaction of N.I.O.C., an applicant is free to pay the Iranian agency 200,000 rials (about $2,500) for a copy of the specifications and agreement forms on which proposals must be made.

Iran will not accept any proposal made after March 31, 1958.

All the propoasls will be considered by N.I.O.C. during April and May, and then acreage awards will be made "in due course."

Types of proposals . . . The new Iranian oil law leaves it entirely to the discretion of N.I.O.C. whether to accept or reject any proposal made to it for new exploration acreage in the country.

Proposals accepted by N.I.O.C. have to be approved by the Council of Ministers and the Parliament.

The oil law permits three types of proposals. They are:

. . . **An independent application** in which the company is expected to offer a bonus for exploratory territory.

. . . **A joint venture** with N.I.O.C. as an equal partner. This is the type of deal offered by the Italian government, Ente Nazionale Idrocarburi.

. . . **A partnership** in which N.I.O.C. is the minor partner. The Iranian interest in this type of venture cannot be less than 30 per cent.

No bonuses are expected in either of the joint venture proposals.

Wildcat Planned in Dominican Republic

A HOUSTON independent has announced plans to drill the first oil test in the Cibao Valley of the Dominican Republic.

H. S. Cole, Jr., & Son, Houston, has let contract to Comet Drilling Co., Lafayette, La., to drill the 10,000-ft. wildcat.

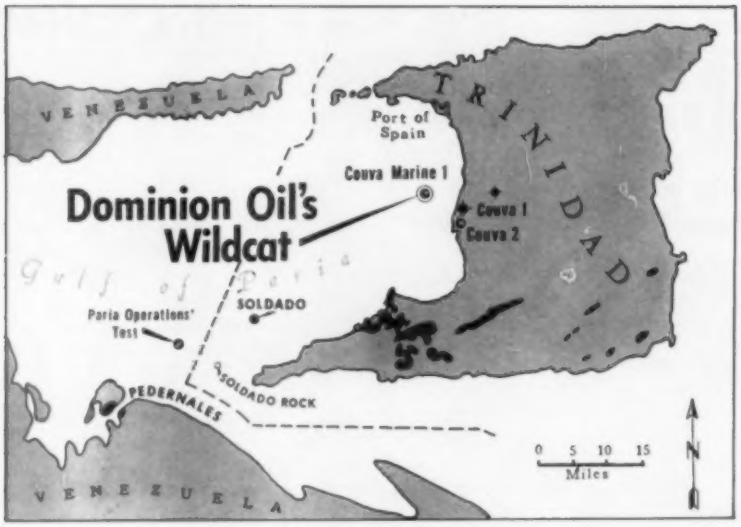
The test will be drilled on a concession covering some 2,100,000 acres in the northern part of the West Indies republic. Exact location has not been announced.

Cole has conducted surface geological studies, gravity survey work, and seismic surveys on the concession under an agreement with Petrolera Dominicana, C.A., concessionaire of the Dominican Government.

Plans call for the initial test to be spudded within a few weeks. A drilling rig and other equipment will be shipped from Lake Charles, La., for arrival at a Dominican port by about December 1.

The concession covers an area about 150 miles long and 20 to 25 miles wide. Most of the acreage is between Cordillera Septentrional and Cordillera Central, prominent mountain ranges.

A spokesman for Cole said that oil seeps have been found and wells have been drilled in other sections of the Dominican Republic but that the Cibao Valley has never been drilled. Keith McLaughlin will be in charge of the operation for Cole.



Trinidad Test Drilling

Standard of California subsidiary using floating barge to drill wildcat in 40 ft. of water in the Gulf of Paria

TRINIDAD may complete an oil well drilled from a floating barge before either the California Coast or the Gulf Coast can prove the revolutionary new drilling technique.

A number of companies operating off California have been drilling core holes from a floating barge for more than a year (OGJ, Oct. 7, p. 100). Just a week ago two Houston engineering firms revealed they have used a similar technique drilling for sulfur in the Gulf of Mexico and plan to drill for oil (OGJ, Nov. 4, p. 92).

Last week a Trinidad company was quietly drilling below 1,000 ft. on what might well be the first oil well ever drilled over water from a nonstationary drilling device.

The company, Dominion Oil, Ltd., is a wholly owned subsidiary of Standard Oil Co. of California. Neither Dominion nor its parent company is calling the operation a wildcat. They say it is "primarily" a stratigraphic test. But, Caribbean oil men, from Maracaibo to Cuba, think this one is for keeps.

The average depth of producing wells completed last year in Trinidad was 4,372 ft., but many of the islands fields, especially the older ones, produce from much shallower depths than this. Trinidad Northern Areas, Ltd., has established the island's only offshore production from the Miocene at 4,400-4,800 ft.

Socal spokesmen won't reveal the size of the barge being used or the projected depth of the first hole, but they concede the barge is equipped with a National 55-A rig capable of going to 8,000 ft. The company is using about the same technique the C.U.S.S. combine developed for California tidelands work.

The well, Couva Marine 1, is being drilled in 40 ft. of water 4½ miles off the west coast of Trinidad about 13 miles south of Port of Spain (see map). It is about 32 miles to the northeast of Trinidad's only offshore field, Soldado, which now has three producers. It is about 45 miles northeast of the Gulf of Paria location now being drilled by a four-company combine in Venezuelan waters.

Dominion holds a large offshore block of acreage in this region. The company has about a million acres, both offshore and on land, on the little Caribbean island.

The company has so far confined its Trinidad operations to the northern, and as yet unproductive regions of the island. The firm has drilled three wildcats in the northern region. All had gas shows. One of them, Freeport 1-A, tested better gas shows than the others, but was later abandoned as noncommercial. It is in the same area as Couva Marine 1, but about 5 miles inland.

The C.U.S.S. technique . . . One type of floating barge operation has been used off California for drilling in water depths up to 1,500 ft. and has drilled holes as deep as 6,300 ft. The C.U.S.S. group (Continental, Union, Shell, and Superior) is enthusiastic about its results after a year's work on core holes.

The system involves the use of underwater wellhead equipment, and eventually, ocean-floor completions.

In this ocean-floor drilling technique, drill pipe is lowered through the barge to the bottom. A surface hole is jet-drilled through silt to a compact formation. Then the hexagonal base, surface casing, casinghead, and blowout preventers are lowered to the ocean floor as a unit. Surface casing is cemented and the drilling starts.

Gulf operation . . . Brown & Root Marine Operators, Inc., and McClelland Engineers, Inc., both of Houston, last week revealed that they have two floating barges which have been working in the Gulf of Mexico for 18 months on a sulfur drilling program.

The firms have drilled 34 holes in the 2,000-3,000-ft. range for a sulfur company off Galveston and High Island. They plan to put the larger of the two barges to work on a stratdrilling program for an unidentified oil company.

These barges have not, as far as is known, completed any Gulf of Mexico wells on the ocean floor. Wellhead equipment has been above water.

Sahara Line Talked

Libya, Tunisia approached on pipeline right-of-way

THE FRENCH SHELL CO., which made the first oil discovery in Algeria's Sahara Desert, has reached the "official" talking stage about an international pipeline to the Mediterranean.

Officials of Cie. de Recherches et d'Exploitation de Petrole au Sahara (C.R.E.P.S.) are talking to the governments of both Libya and Tunisia about pipeline rights of way.

Actual route of the line from Edjele field in extreme eastern Algeria probably will be decided on political terms. It could move either through Libya or Tunisia, depending almost solely on which country is more reasonable.

The line would be slightly shorter through Tunisia, but this nation's active sympathies with the Algerian nationalists may pose serious problems.

Tunisia's president, Habid Bourguiba, would welcome the pipeline, but he says frankly he doesn't think the French will move Saharan oil until

they settle with Algeria's nationalists (OGJ, Oct. 21, p. 86).

The 16-in. pipe for the line has been on order from French mills for several months. C.R.E.P.S. officials said last week they plan the first Mediterranean tanker loading of Edjele crude for March 1960.

The Royal Dutch-Shell Group owns a 35 per cent interest in C.R.E.P.S. French capital, primarily the government's, controls the majority interest.

Pakistan Refinery Studied

THE PAKISTAN GOVERNMENT expects representatives of four international marketing companies to present detailed plans for a major Pakistan refinery—probably in the Karachi area.

An 8-man commission, composed of a refining man and a marine transport man from each of four companies, left Pakistan last month after a detailed study of the proposed refinery. The commission will make its report to the four companies which, in turn, will report to the Pakistan Government.

The government several months ago asked Burmah Oil Co., Ltd., Shell Petroleum Co., Standard-Vacuum Oil Co., and California Texas Co. to submit a proposal for a refinery (OGJ, July 29, p. 126). To date there has been nothing definite disclosed about proposed throughput of the plant, but presumably it would be designed to meet the country's internal needs and also to export products.

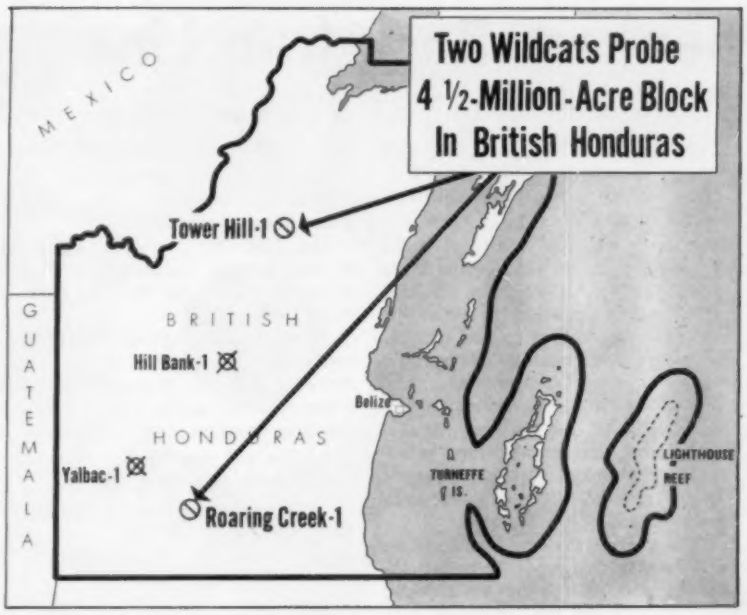
The only refinery now operating in Pakistan is the 5,000-bbl.-daily refinery at Rawalpindi, operated by Attock Oil Co., Ltd. The proposed refinery would operate on imported crude.

B.P. Testing Turbodrill

THE FIRST turbodrill ever used in Great Britain is being tested by B.P. Exploration Co. at Egmanton field in Nottinghamshire.

The French-manufactured turbodrill is being used to drill 3,000-ft. development wells in the shallow field. The British Petroleum Co. subsidiary is using the new tool on a test basis. Results at Egmanton will determine whether or not the drill will be used in B.P. drilling programs in other parts of the world.

Egmanton is one of a series of half a dozen small producing fields which B.P. has discovered in northeast England. Egmanton produces about 660 bbl. daily from 18 wells pumping from sands found between 3,100 and 3,400 ft.



Shell Takes Gulf Farmout

SHELL PETROLEUM CO., LTD., last week took a 50 per cent farmout on the 4,552,000 acres held under concession by British Honduras Gulf Oil Co.

No terms of the agreement were divulged by the two companies, but the move came just a month after Gulf resumed its drilling program in the British crown colony after no drilling for a year.

The Gulf subsidiary now has two rigs at work in the northern half of the little Caribbean country. One rig at Roaring Creek was drilling below 2,300 ft. The other had cut 300 ft. of hole at Tower Hill. Roaring Creek is 50 miles southwest of Belize, the colony's principal town. Tower Hill is 50 miles northwest of Belize. Both are Kerr-McGee Oil Industries, Inc., rigs.

Gulf moved a contract rig out of the country a year ago after drilling two dry holes. The company said it wanted to review the data obtained in the unsuccessful wells before doing any more drilling. At that time Gulf held the entire colony under concession.

In September, the crown colony government renewed Gulf's concession for the northern half of the country. The government gave Gulf until October 20 to select 1,000 sq. miles of the southern sector it wanted to explore further. This left another 3,000 sq. miles open (OGJ, Sept. 16, p. 117).

Gulf's first two tests in British Honduras were watched closely by a dozen American oil companies who at that time were applying for acreage in neighboring Guatemala. The first well, Yalbac 1, was less than 20 miles from the Guatemalan frontier and directly opposite the Peten region which is regarded as a prime Guatemalan target. The test was abandoned at 9,000 ft. in April 1956. The rig was moved 25 miles northeast where it drilled Hillbank 1, abandoned at 6,650 ft.

Upper Sands at Manifa Dry

ARABIAN AMERICAN OIL CO. has suffered at least a minor setback in its efforts to establish a second offshore producing oil field in the Persian Gulf.

Aramco said last week that its new offshore test of the Manifa structure is below 6,220 ft. It found two sands dry which the company hoped would be productive.

Manifa 1, about 8 miles off the Saudi Arabian coast and about 20 miles south of Safaniya field, was spudded late in September with the "Queen Mary," Aramco's drilling barge (OGJ, Oct. 14, p. 121).

Both the Bahrain and Zubair sands are productive in Safaniya field, and Aramco planned to test both in the new offshore structure. Last week the company said both the upper and lower Bahrain sands are dry in the first test. The well is drilling ahead to test the Zubair.

Bankers Back Iran Line

Murchison money not promoting big-inch line to Turkey; success of project depends on new oil strikes at Qum

NEW DETAILS came to light last week on plans of a new American company, Elburz Oil Corp., to build a 1,000-mile, big-inch crude line from Central Iran to Alexandretta, Turkey.

The line will provide an outlet for production in the Qum region of Iran and will be undertaken in partnership with the Iranian Government.

Frank Schultz, vice president of Canadian Delhi, Inc., a Clint Murchison interest, has been named president of the new company. He told The Oil and Gas Journal last week, however, that Elburz Oil so far is 100 per cent owned by Allen & Co., New York investment bankers. Murchison has no interest in the project now. It's possible that he might take an interest later, Schultz said.

Schultz is a veteran in promoting and organizing new pipelines. He was one of the principal figures in the birth of what has become the huge Trans-Canada gas-transmission system.

The Iranian line, if it materializes, may develop much like Trans-Canada. Initial backers will carry the ball until it appears the project will go through, then interests in the deal may be parceled out to others.

The pipeline . . . The Shah of Iran will make the first formal announcement of the pipeline agreement between Elburz and National Iranian Oil Co., the government agency.

Schultz said this will be presented to parliament for approval within the next 2 weeks.

The plan calls for a $450 to $500-million line crossing northern Iran capable of carrying 400,000 to 600,000 bbl. daily of oil to the Mediterranean (OGJ, Oct. 14, p. 120). The agreement is conditioned on Iran's developing sufficient reserves in Central Iran from the Alborz area and two or three other unexplored structures to justify such a project.

Specific terms of the contract which Elburz Oil signed with N.I.O.C. will not be made public until after the proposal has been presented to the parliament.

It is known, however, that N.I.O.C. will operate the Iranian section of the line. Elburz will build the entire system and operate the Turkish portion.

Oil development . . . The project has several high hurdles to clear before it can become a reality.

The first, of course, is approval by the Iranian parliament. Schultz hopes this will be cleared without much difficulty.

After government approval is received, the company likely will remain a skeleton organization until crude reserves can be proved through a drilling program planned by N.I.O.C.

Results of new drilling won't be known for a year or more.

Schultz reported it now appears that N.I.O.C. has a dry hole at its first stepout from the prolific Qum discovery. The failure reportedly is due to poor location on the structure. The company is now preparing to spud another test.

Within a short time, N.I.O.C. expects to have five or six rigs working continuously on this and other structures in the general area. A contract already has been signed with Southeastern Drilling Co., Dallas, to bring in two rigs. The government company also plans to buy rigs and operate them itself.

Schultz said he plans to go to Iran soon with Charles Allen, head of Allen & Co. They will arrive in time to make a joint announcement with the Shah on the pipeline project.

Stanvac Adds Unit

First cat cracker goes on stream in Southeast Asia

THE FIRST cat cracker in Southeast Asia has gone on stream at the 31-year-old, 71,000-bbl. refinery operated by Standard Vacuum Oil Co.'s Indonesian affiliate near Palembang, Sumatra.

The new unit, a 11,400-bbl. fluid catalytic cracker, was built by Foster Wheeler Co. The $8-million unit will enable the Sungei Gerong refinery to produce 6,140 bbl. daily of high-octane gasoline components from Indonesian crudes.

The new cracker is a part of Stanvac's 4-year, $80-million expansion program for all its facilities in Indonesia. New process units for the Sungei Gerong refinery account for $31 million of the total. In addition to the cracker they include a reformer stabilizer, a 4,370-bbl. catalytic polymerization unit, a sulfuric acid unit, and auxiliary facilities.

The first two large gas turbines in Asia outside Japan are installed in the new cracking unit. The two 3,000-hp. turbines burn refinery gases.

H. F. Prioleau, Stanvac president, said the refinery modernization program will help his company meet rising market needs for petroleum products. He pointed out that Stanvac's market demand for products "east of Burma" increased from 81,000 bbl. daily in 1950 to 175,000 bbl. daily last year.

Sui Gas Use Rises

Karachi industry taking most of field's supply

WEST PAKISTAN'S consumption of natural gas from the Sui field has increased 100 per cent in the last year.

During September, the gas consumption reached a peak of 35,000 M.c.f. daily in a single day. The monthly average was about 31,000 M.c.f. daily.

In Karachi alone, industrial and commercial users accounted for 600,000 M.c.f. of the Sui gas for the month of September. Consumers outside the Pakistan capital accounted for another 340,000 M.c.f. for the month.

The Sui natural-gas supply, even on a rather limited scale, allows fledgling Pakistan to save the foreign exchange needed to buy about 6,000 bbl. of oil daily or 1,300 tons of coal.

Household use of the gas is still in its infancy. Sui gas now is being supplied to about 200 homes in Karachi, and plans are under way to supply another 150 homes. A 6-in. main is being laid to serve more industrial and commercial users in the city.

New Maracaibo Shipyard

LEVINGSTON Shipbuilding Co., Orange, Tex., will operate a new shipyard to be built by a Venezuelan firm on the shore of Lake Maracaibo.

The shipyard will specialize in building and repairing marine equipment for use by the oil industry in Lake Maracaibo and other South American waters.

Levingston is a stockholder in the new shipbuilding firm, Varadero y Astillero del Zulia Cia. An. The company will be known as "Vazca."

Ed T. Malloy, Levingston president, said the firm will build various types of marine equipment including ships, tugs, barges, drilling units, and tenders.

OIL AND GAS JOURNAL

....OIL Looks Ahead

A FORECAST OF TRENDS THROUGH '65

DEMAND gains for oil and gas will tend to level off. Gains will continue because the population is growing three times as fast as in 1936 and everyone is just using more oil. But the rate of gain will slow down.

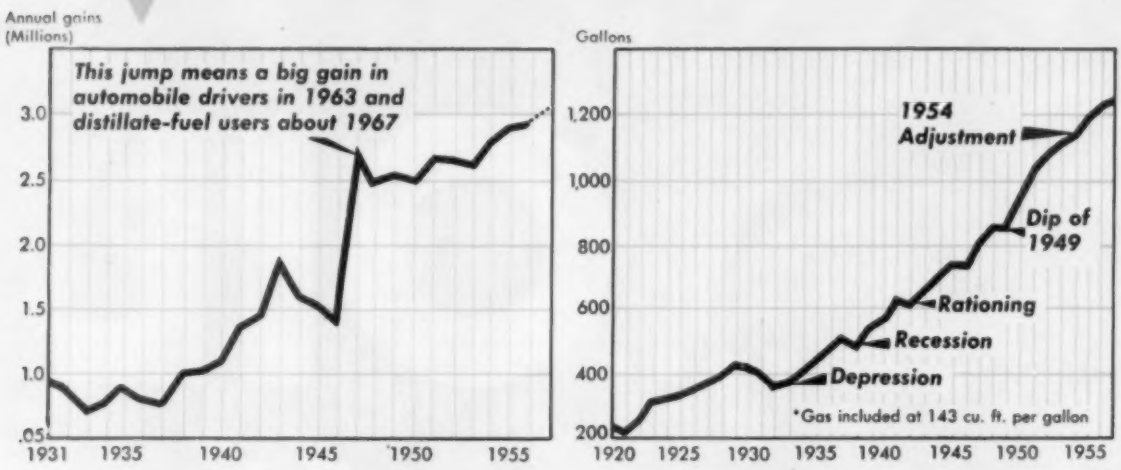
PRODUCTION to fill these needs will find imports increasing, but domestic output also making good gains.

EXPLORATION MEN will be on the spot: They must find more oil and gas to replace production and keep a safe ratio of reserves. This means stepped up drilling.

PIPELINERS AND REFINERS will feel the pressure. Pipeline capacity must increase, especially for products. Refining capacity will move past 12,000,000 bbl. daily by 1965. Gas-liquids output also will rise sharply.

PROCESSING techniques will see the biggest change. The pressure will come from the trend toward higher and higher gasoline quality.

Population is growing 3 times as fast as in '36



. . . per capita use of oil and gas is gaining, too

DEMAND is bound to keep increasing through 1965.

This is true because the oil and gas industry rests with people.

Health of the industry is tied closely to such delicate occurrences as births, licensing teen-age drivers, marriages, deaths, social habits.

Fantastic? Hardly. Oil economists charting the demand for 1965, for instance, express it this way: Volumes required that year will equal the number of people in the country times the per capita consumption of oil and gas.

In other words, demand will be the number of customers times what they buy. So all estimates start with people.

America's population has been growing for many years. This picture from the early thirties is shown in the chart. For the 10-year period 1930-40, the average annual gain in population was about 900,000. A big change came in 1947. The gain for the 1947-56 period was 2,700,000 a year or about three times the gain during the thirties.

Babies future customers . . . These changes in population also influence changes in petroleum demand.

Take just two results of the baby crop: New drivers and marriages.

The children born in the 1930-40 period became eligible for drivers' licenses between 1946 and 1956. Those born in the 1947-57 period will start driving about 1963.

The average annual gain of American population in the more recent periods has been about three times the gain in the thirties. Some of this increase stemmed from the tendency of people to live longer. Part of the gain thus was in the older age groups.

The gain in the birth rate and recent reports of population by age groups indicate that the annual new additions to the driver rolls after 1963 will be about twice the rate for the 1946-56 period.

Twice as many new drivers will mean larger gains in number of autos on the road. And more cars will mean more gasoline demand.

The postwar babies who become drivers about 1963 will start getting married about 1967. The new family formations will boost the demand for housing and also the demand for heating oil. This big increase will be felt in the years after 1967.

What's ahead . . . The oil industry has been enjoying a double dividend from population growth: While customers have increased, the per capita consumption also has climbed rapidly.

This trend since 1920 is shown in the chart above. If gas consumption is included on an energy-equivalent basis, per capita consumption of oil and gas averaged about 240 gal. in 1920. It climbed to about 1,240 gal. by 1957.

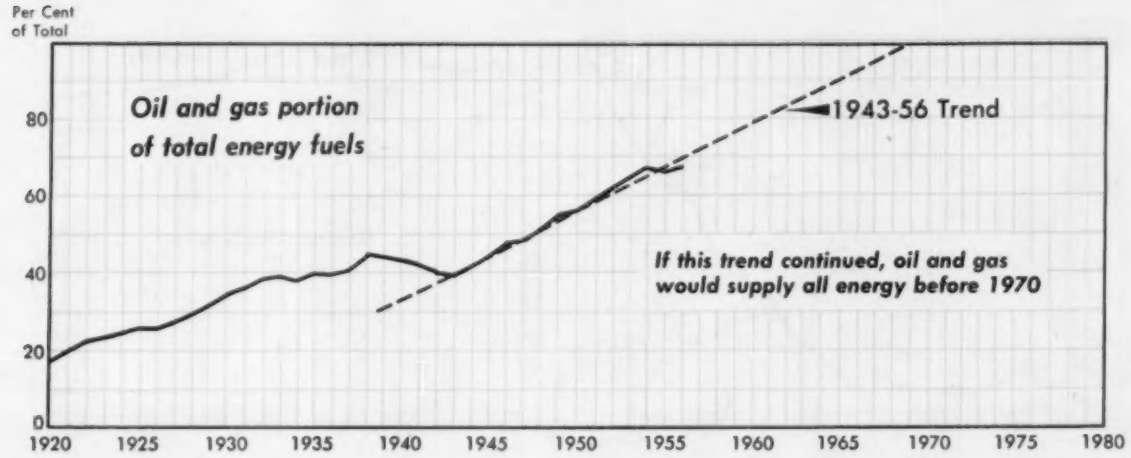
This rate of increase cannot continue, however.

Much of the gain in petroleum demand can be credited to displacement of other fuels. The exact extent of this displacement is not known. But the changing relation of petroleum to other energy fuels (chart on next page) tells the general story.

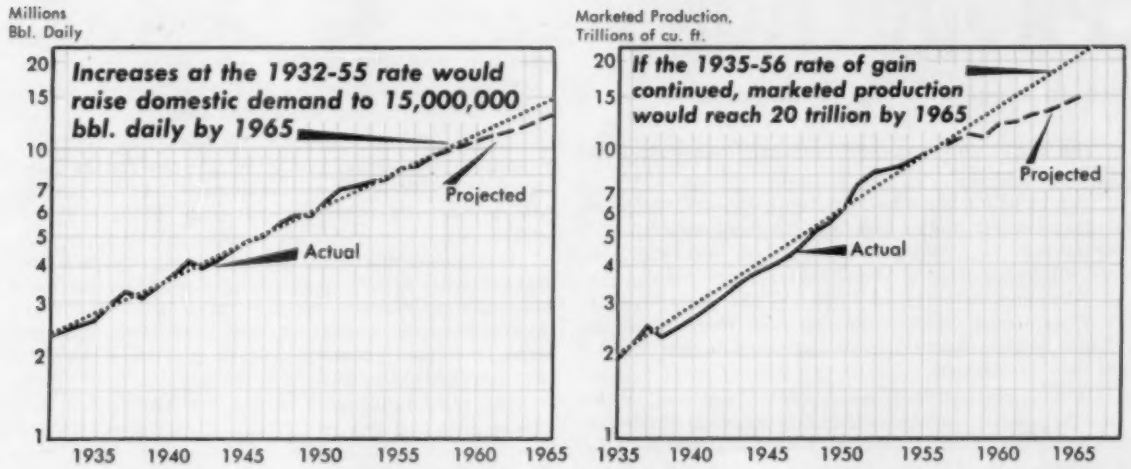
Oil and gas in 1920 supplied slightly less than 18 per cent of total fuel energy in this country. By 1943, the ratio had climbed to 39.7 per cent. The portion was 66.9 per cent by 1956. If petroleum consumption should continue at the 1943-56 rate of gain, oil and gas would supply 100 per cent of the energy demand before 1970. Obviously this won't occur.

This means that in the future oil will replace other fuels at a slower rate, and the percentage gain in demand will be off a little.

How this works is pictured on opposite page where domestic demand for products is plotted on a semilogarithmic scale. In this scale a straight line shows a constant percentage increase each year. There were only minor deviations from this line for the 1932-55 period. But to continue this rate of increase to 1965 would result in a demand of 15,000,000 bbl. daily. The truer forecast for 1965 is 13,250,000 bbl. daily.



But these gains can't continue at past rates



Oil demand will level off . . . and so will gas

A similar situation prevails in marketed production of natural gas. During the 1935-56 period, the average gain was 8.2 per cent a year. If this same rate were extended to 1965, the demand figure would be slightly more than 20 trillion cubic feet for the year. The actual forecast for 1965 is 15 trillion cubic feet.

Oil vs. natural gas . . . Petroleum and natural gas actually may find themselves friendly competitors for a share of the expanding U. S. energy market.

A recent economic study estimated that the nation's growing population, expanding economic activity, rising standard of living, and greater mechanization would result in 45.6 per cent increase in demand for energy between 1956 and 1966.

This study made by economists of Chase Manhattan Bank predicted that petroleum would grab off a greater share of this new market than natural gas. Oil should show a 63.6 per cent gain in energy supplied during the period. Natural gas is expected to increase by only 57.6 per cent.

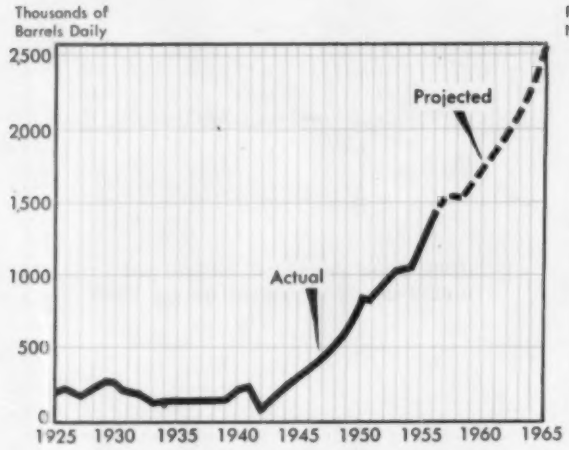
The spectacular growth rate of natural gas in the postwar era has been attributed in a large degree to its displacement of coal. In many urban areas gas also competed successfully with oil for new markets.

But this trend is not expected to continue. Potential conversions to gas from coal have been sharply curtailed. Oil products may be able to compete more effectively in the rapidly growing suburban areas.

For the last half of the next decade the growth of natural gas will stay nearly in line with the expansion rate of over-all energy. Oil likely will grow somewhat faster. This is expected because oil is considered a more versatile fuel and has numerous markets which are exclusively its own.

A look at the prospects for energy, however, assures that both oil and natural gas will be in big demand for the next decade.

Imports will grow . . . get more of the market



PRODUCTION must rise to meet this higher demand.

This means an increase for both imports and domestic crude production.

The trend for imports to take an ever increasing share of the domestic market has been changed recently with introduction of voluntary controls. The long-range outlook still is for imports to increase, however.

Total imports averaged 1,426,000 bbl. daily in 1956. They were only 337,200 bbl. daily in 1946. Thus the 10-year period showed an average annual gain of 14.3 per cent for imports.

If total imports were to continue increasing at this rate the annual average would have reached 10,000,000 bbl. daily by 1971. This in itself indicated the need for a cutback.

The campaign by domestic producers to reduce this ratio of imports to domestic production culminated in voluntary controls and resulted in cuts in total imports for the last half of 1957.

If this downward trend holds, the import portion of total supply next year may be down to 15.3 per cent. This level may hold through 1960 with only minor changes.

Unless restricted by law, however, imports are expected to start climbing again after 1960.

The forecast of 2,610,000 bbl. daily for 1965 indicates an average annual gain of 8.7 per cent for the 5-year period from 1960. Domestic demand for oil probably will increase 4.5 per cent each year during the same period.

This means that crude production may reach 9,470,000 bbl. daily by 1965 and still leave room for 2,610,000 bbl. daily of imports. On the chart the domestic production line tends to level off some after 1960. This only means that the percentage gain in production for 1965 may be slightly less than for 1960.

The comparative story for gas for 1965 is this: Total consumption and loss are forecast at 16,320 billion cubic feet. Imports from Canada and Mexico will supply about 550 billion of this demand. Domestic production is projected at 15,770 billion. Again this includes marketed production plus waste and loss.

Reserves must climb

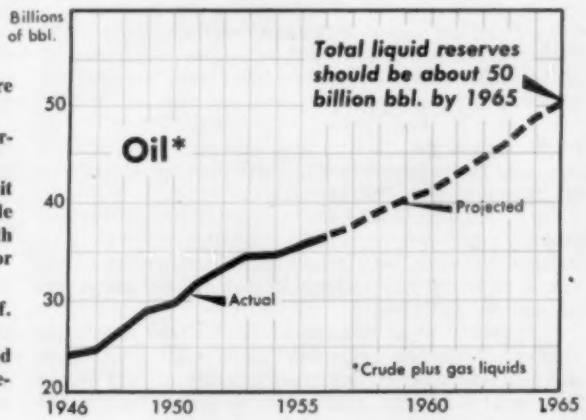
. . . Because they provide insurance against a future energy shortage.

. . . Because they allow operators to produce reservoirs at their most efficient rates.

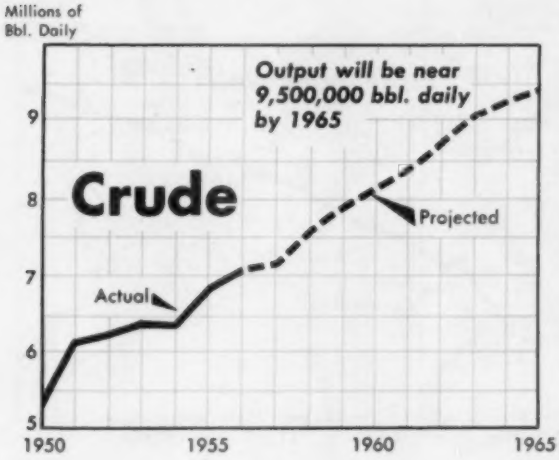
Actually the need for conservation sets a lower limit to the ratio of reserves to production. Since 1946, crude reserves have averaged 12.4 times crude production with the range from 13.6 to 11.6. Reserve-production ratio for gas dropped from 32.5 to 21.8 between 1946-1956.

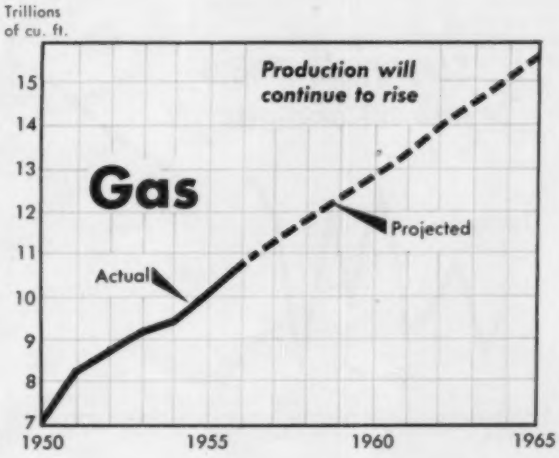
Downward trend of these ratios will tend to level off. Crude at about 11-12; gas at about 19-20.

As long as production is rising, operators must find enough oil and gas to replace production and raise reserves enough to maintain minimum ratios.



But domestic production also will show gains





RESERVES will have to keep pace with this activity.

It's a truism of oil economics that when production steps up reserves backing up this production also must be increased.

This is true except for relatively short periods when reserve producing capacity has been built up beyond actual demand.

At the present this country has sufficient excess producing capacity to cover short-term abnormal demands for domestic crude. But it does not have the proved reserves to back up expanded future demands without a program of exploratory and development drilling.

What the nation faces in drain on reserves is shown by these figures:

Over the next 10 years, crude production in this country will add up to more than 32 billion barrels. That's more crude than the presently known proved reserves.

It will not be enough to find 32 billion barrels of crude over the next 10 years because the current level of reserves would not support the production rate expected for 1967.

The ratio of crude reserves to production has been dropping in recent years, but it cannot continue to decrease indefinitely.

Crude reserves at the end of 1954 represented 13.1 times crude production that year. The ratio dropped to 12.4 in 1955 and to 11.9 for 1956.

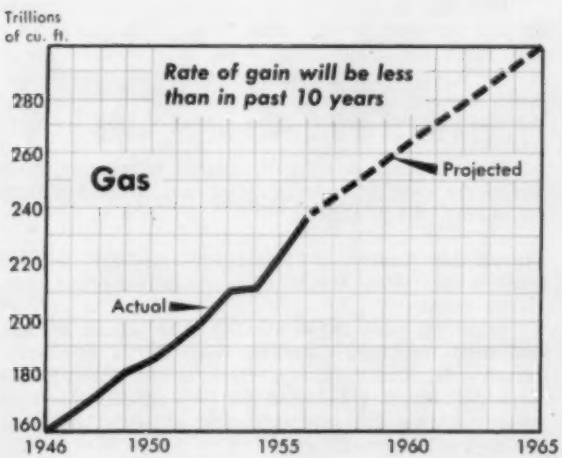
The physical characteristics of producing formations tend to limit the decline of the reserve-production ratio. To say that production can continue to climb without increases in reserves could be carried to the ridiculous conclusion that all reserves found in a year could be produced in that year.

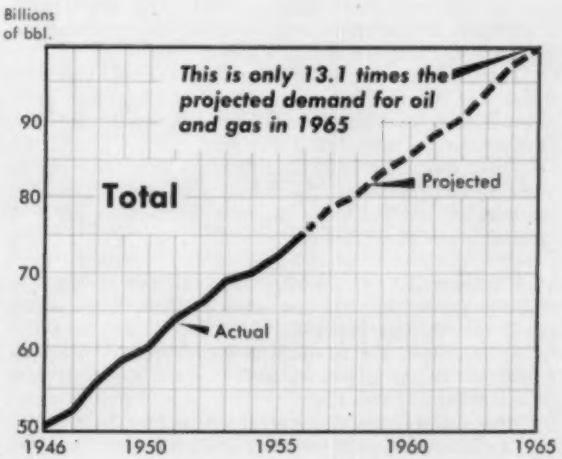
Reserves in 1965 then should look like this:

. . . About 41 billion barrels of crude based on an annual level of 3.46-billion-barrels production.

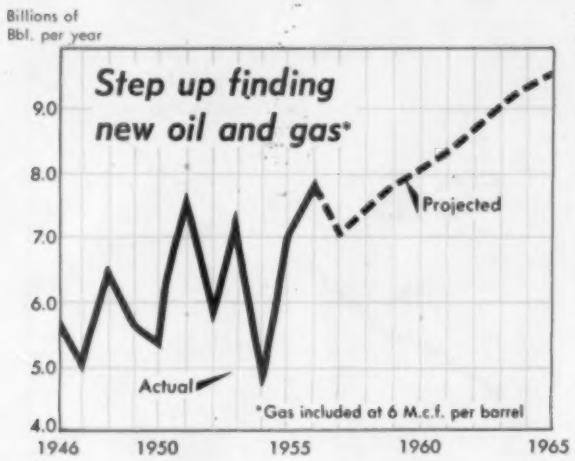
. . . At least 9 billion barrels of gas-liquids based on slightly more than a half billion barrels production.

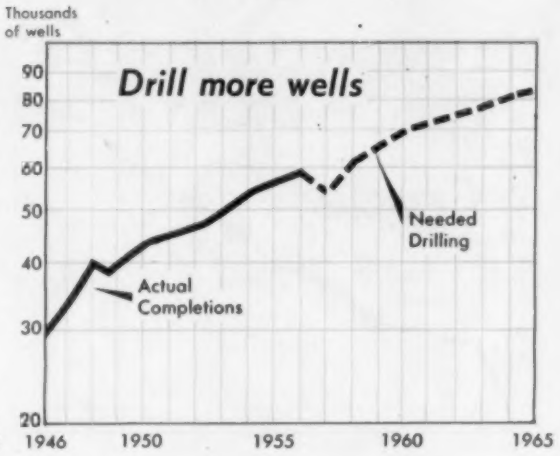
. . . 300 trillion cubic feet of gas. This means replacing present reserves as they are produced plus adding 60 trillion cubic feet.





To maintain reserves will require that we:





DRILLING is certain to recover from its present slump.

And drilling contractors face a busy 9 years ahead if they succeed in meeting demands for oil and gas.

Briefly here's what they must come up with:

. . . **Liquids**—45 billion barrels of new oil. This is broken down to 14 billion barrels added to reserves and 31 billion barrels to replace that produced.

. . . **Gas**—184 trillion cubic feet or the equivalent of 31 billion barrels of new gas. This breaks down to 122 trillion cubic feet to replace production and 62 trillion feet added to reserves.

The total for oil and gas is 76 billion barrels needed during the next 9 years.

The amount of oil and gas discovered in the period will be related directly to the number of wells drilled.

In recent years the average amount of oil and gas found per well drilled has declined.

Oil and gas found per well in recent years reached a peak in 1942 and a low point in 1954. This is true even if additions to reserves through revisions and extensions of old pools are credited to drilling each year.

The total per well in 1942 was 217,000 bbl. This high figure can be credited to restricted drilling that year. Because of war-connected shortage of materials, only the choice locations were drilled that year.

There was a big jump in drilling in 1954. Number of wells drilled increased by 6,650. At the same time the total oil and gas found dropped. Discoveries per well reached a low of 85,500 bbl.

How many wells? . . . Looking ahead, oil and gas credited to drilling over the next few years probably will average about 116,000 bbl. per well.

So if drillers are to find the equivalent of 76 billion barrels of oil and gas in the next 9 years, they will have to cut about 645,000 holes.

That's an average of about 71,670 wells each year.

The actual estimate for 1965 is 82,300 wells based on each well averaging 116,000 bbl. If the trend should shift slightly so that each well would average 119,000 bbl., the industry could get by on about 80,000 wells for that year.

The prospect becomes staggering when this fact is pointed out: The 645,000 wells needed in the next 9 years represent nearly 40 per cent of all the wells drilled in this country since the Drake discovery.

They'll be deeper . . . But the job ahead for drillers is even greater than the number of wells indicates.

Holes of the future will be deeper. Many oil men feel there are few geographical frontiers left in this country for the driller. The current challenge lies in the deep sedimentary basins. Some of these will require drilling to depths lower than 30,000 ft.

This big oil hunt of the future will call for changes in equipment and technique of drilling as well as producing.

Latest estimates indicate that 48 per cent more money will be required to drill the 41.5 per cent more wells needed in 1965. The forecast calls for a capital outlay of $6,625,000,000 for drilling and production in 1965 compared with $4,475,000,000 in 1956.

Total expenditures for the 1957-61 period are estimated by Chase Manhattan Bank economists at $25,625,000,000. During 1962-66 they probably will be $31,950,000,000.

Thus the estimated grand total of drilling and production spending for the next 10 years in this country may reach $57,575,000,000.

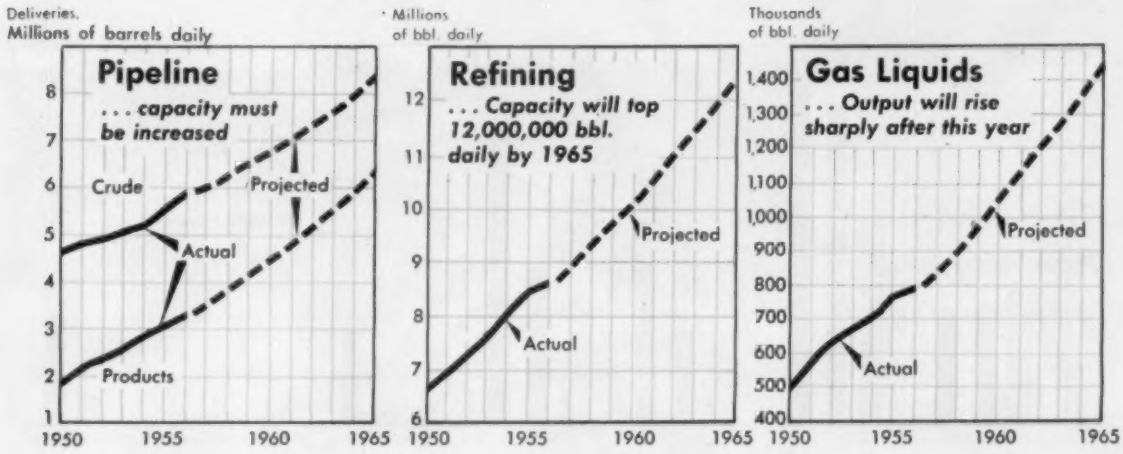
During the same period expenditures abroad annually will rise from $1,600,000,000 this year to $2,725,000,000 in 1966. Total for the period will be $18,850,000,000.

This all means that the oil industry in the free world within the next 10 years will lay out $76,425,000,000 on drilling and production.

What'll they find? . . . These figures inevitably lead oil men to ask: How much oil will eventually be found in this country?

Naturally, none knows exactly. Best guesses are that total crude produced will range from 300 to 350 billion barrels (OGJ, Oct. 21, p. 68). When the 85.6 billion barrels already produced up to the end of 1956 are deducted from these estimates, the general outline of what lies ahead for drillers becomes clearer.

These trends will follow automatically:



PIPELINING will see a big capacity increases. So will refining.

The refiner and pipeliner, like the explorer and driller, will need to step up production to handle the increased volumes forced by growing demand. Here's an indication of what these segments of the industry face:

Crude runs at refineries in this country in 1950 averaged 5,739,000 bbl. daily, about 85.7 per cent of average capacity. By 1965 crude runs will climb to about 11,200,000 bbl. daily—almost double the 1950 rate. This will call for total refining capacity of about 12,450,000 bbl. daily.

Natural-gas liquids will show an even greater growth. Total output at natural-gasoline and cycling plants in 1950 was 499,000 bbl. daily. By 1956 it had climbed to 787,000 bbl. daily. It is expected to reach 1,420,000 bbl. daily by 1965.

All this must be accompanied by increased movement of crude and products by pipelines.

There's one trend to bear watching. Because of the trend toward higher imports of crude by 1965, pipeline deliveries of crude to refineries will not have the same growth as pipeline movement of products from refineries.

For the year 1950, refineries received 4,601,000 bbl. daily of crude by pipeline and ran 5,739,000 bbl. daily. The remainder came by tanker, barge, tank car, or truck. By 1965, refineries probably will receive about 8,300,000 bbl. daily of crude by pipeline compared with total runs amounting to 11,200,000 bbl. daily.

Refined products delivered by pipeline more than doubled between 1950 and 1956. The average was 1,081,000 bbl. daily in 1950 and 2,310,000 bbl. daily in 1956.

This type of pipeline movement will more than double again in the 1956-65 period. Product movement is expected to average 5,300,000 bbl. daily by 1965. This total will include natural-gas liquids as well as products from refineries.

The refiner and pipeliner, like the driller, must lay out a vast amount of capital to meet this expansion. Estimates on this spending are:

. . . **Refining and chemical plants** will require $857,000,000 this year, rising to $1,025,000,000 in 1960 and $1,375,000,000 in 1965. The 10-year total is $11,175,000,000.

. . . **Transportation** and marketing will require $850,000,000 this year, $1,000,000,000 in 1960 and $1,450,000,000 in 1965. The 10-year total is $11,500,000,000.

PROCESSING shifts will result from quality demands.

The emphasis will be quality for many years to come. In fact, valid projections can be made today on no other basis.

The prophets of the gas-turbine or free-piston era have been noticeably silent in recent months. They aren't saying now when, or even if, the piston engine ever will be displaced by these types in the passenger-car field.

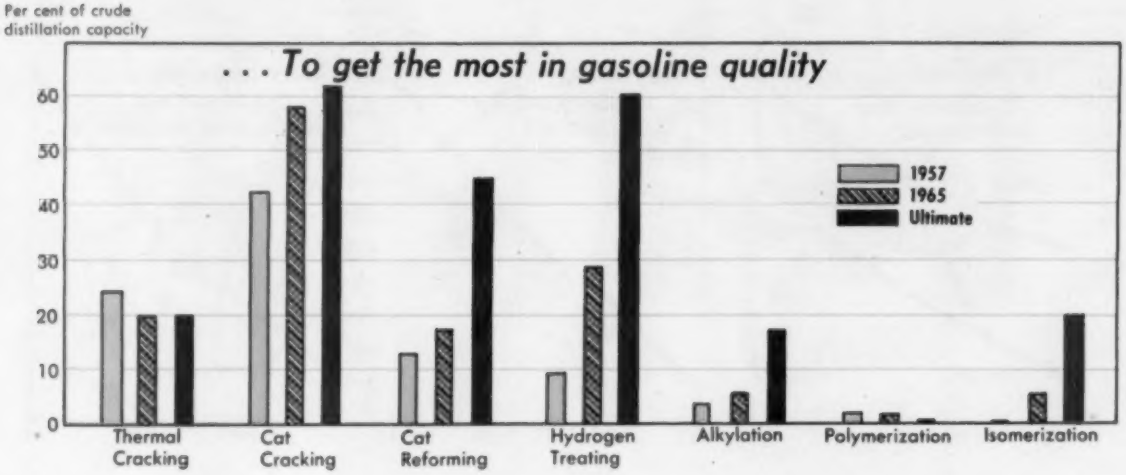
This means that the processing of petroleum for octanes will remain paramount well beyond the economic life of refining facilities to be built for several years to come.

How far will this trend progress? No one knows today, but the ceiling of compression ratio for piston engines of the future is showing signs of rising. Whereas 12:1 has long been considered close to the limit, there is increased talk of 14:1. Even 16:1 in highly bred spark-ignited engines has been mentioned in some circles.

How fast will this future rise in fuel octanes project? Again, no timetable is valid today. Too much depends on imponderables: Automotive developments aimed at making better use of fuel octanes, economics in both industries, and specifically, the competitive climate which will spark power and octane races over the next several years.

The charts depicted here are, then, guesses. They represent a rough consensus among research people of what the refining structure may resemble in 1965, and

Here's how processing will change . . .



how far the industry may eventually go in applying today's processes.

There are signs that the octane race is slowing down in terms of R.O.N. advancement per year. Even so, the projection of what the 1965 refinery will comprise may well be conservative. If premium-grade octane averages 102 or 103 by that date, refiners will need all the quality improvement techniques now at hand.

Severities head up . . . Catalytic reforming will by then, be used for all virgin and thermal feed stocks falling in the admissible processing range. The degree of severity in reforming operations will approach the economic limit on yield. That's probably 80 per cent or less. Moreover, light reformate will be largely reprocessed by catalytic or thermal reforming to realize the full octane potential from these feed-stock types. Other trends:

. . . Catalytic cracking will grow in use, primarily for increasing the yield of distillates from heavy fuels. The total feed rates to reactors will be boosted by dipping deeper into the bottom of the barrel and by recycling more heavy catalytic stocks to extinction.

. . . Hydrogen treating by 1965 will be a "must" for all reforming feeds, and for much of the virgin and cycle charge to cat cracking. It will find further use in desulfurizing and saturating jet fuels and other distillates and specialties.

. . . Alkylation and isomerization will loom important by 1965.

Alkylation will replace polymerization to some extent. Conversion of butylenes and the C_3 and C_5 olefins to branched-chain paraffins should be well advanced by that date. Alkylate production will become diverted more and more into motor fuel as avgas requirements shrink.

Isomerization of pentane should be approaching saturation by 1965. By then the conversion of normal hexane and heptane streams should also be under way, to different degrees in different refineries.

The ultimate picture . . . Just how far can refiners go to realize the highest quality motor fuel? A long distance, if economics is omitted from the picture.

The eventual roads to superhigh-octane motor fuel visualize essentially a chemical operation. Crude would be broken down to the point where little if any virgin materials would find their way into gasoline.

Severity levels of catalytic reforming and cracking and of thermal or hydrocracking will be high. The need for high-octane branched-chain paraffins and aromatics will exceed the supply from our conventional processing schemes today. This means more reprocessing of streams which now blend into gasoline.

Catalytic gasoline as such will need to be fractionated to segregate the highest octane components for motor fuel blending. The remaining fractions then will be hydrogen treated, then catalytically reformed and isomerized to get greatest yield of the higher aromatics. Cat cracking will remain in the picture, however, to get the greatest distillate yields.

Catalytic reforming in turn will fail alone to suffice in turning out quality fuel blends. Light reformate may well become an added charge to isomerization units. It will boost the yield of the important branched-chain paraffins.

The segregation of specific light hydrocarbons will become an important part of this ultimate scheme for making octanes. Specific isomerization may become possible to get more of the various high-octane homologs at the expense of the low-octane ones.

Whether thermal cracking remains a part of this ultimate picture is questionable. Probably, severe hydrocracking will come into the picture. In that case, it will invade or replace the thermal capacity position in the projected scheme of processing. But this technique hasn't a direct bearing on octane as compared to thermal conversion. Hence its inception will depend on the economics of converting heavy fuel stocks to distillates.

In the absence of particulars on engine requirements, jet fuel demand, the burning oil market and the price of heavy fuel, one can only generalize on the long-range future of refining. Assuming, however, that the price of high-octane gasoline will pay its way, estimates shown here are considered reasonable for 1965 and for some possible date thereafter.

The price of gasoline is all-important. It is estimated that the scheme for 1965 would require a 30 to 40 per cent increase in capital cost of processing facilities alone. The ultimate scheme entails a doubling of investment over today's picture, in terms of today's dollars.

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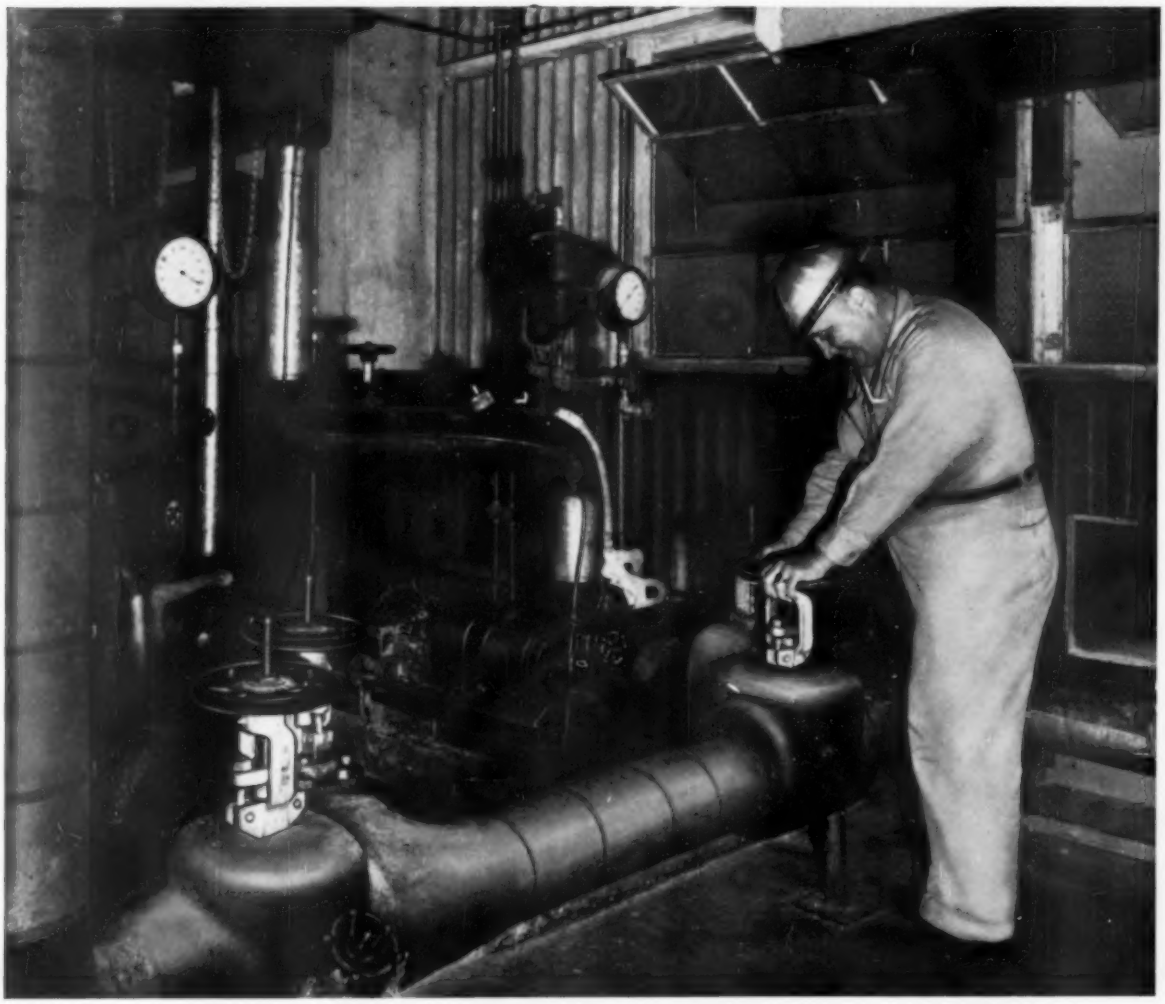

How Cit-Con handles hard-to-hold hot wax

Two years ago, Cit-Con Oil Corporation, Lake Charles, Louisiana, completely revised and modernized the operations in its wax slabbing plant.

Several 3-inch Crane 47-X cast steel wedge gate valves, with Exelloy trimmings, were installed in hot wax lines leading from the pumps. Operating temperature was 180° F., with pressure at 60 psi.

In two years' time, no maintenance service beyond ordinary inspection has been given these Crane valves—*and no leaks have developed.* The valves are operated six to eight times daily.

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PIPELINES

Here's new light on

How Uphill and Downhill Flow Affect Pressure Drop

. . . in two-phase pipelines through hilly country

By W. E. Brigham, E. D. Holstein, and R. L. Huntington

ATTEMPTS at analysis of simultaneous concurrent liquid and gas flow have been largely empirical in nature.

Certain semiquantitative aspects of a two-phase flow system can be readily understood. For instance, Baker[2] has pointed out that when both fluids flow simultaneously through the same pipe, the cross-sectional open area for either fluid is reduced, thus decreasing the effective diameter of the pipe. In single-phase flow, frictional loss is inversely proportional to the fifth power of the diameter.

To illustrate this marked effect, a reduction of only 20 per cent in effective diameter will cause the pressure drop to triple for a constant mass-flow rate.

Paper abstracted from M.S. theses by Brigham and Holstein at University of Oklahoma, where Huntington is research professor, school of chemical engineering. Paper presented at A.S.M.E. Petroleum Mechanical Engineering Conference, September 22-25, 1957, Tulsa.

Bergelin[3] and Gazley[5] studied the energy transfer at the common interface, and velocity gradients in the stratified-flow region.

Martinelli et al.[9] developed one of the first empirical correlations in 1944. The correlation was extended and revised in 1946[10] and 1949[8] by Martinelli and others with the following four possible flow types:

1. The gas and liquid are both in laminar flow.
2. The gas flow is laminar while the liquid flow is turbulent.
3. The gas flow is turbulent while the liquid flow is laminar.
4. The gas and liquid are both in turbulent flow.

The correlation involves the use of an experimentally determined variable ϕ where

$$(\phi)^2 = \Delta P_{TP}/\Delta P_g$$

ΔP_{TP} is the actual two-phase pressure drop and ΔP_g is the pressure drop that would be found if the gas were flowing alone. ϕ is plotted as a function of X where

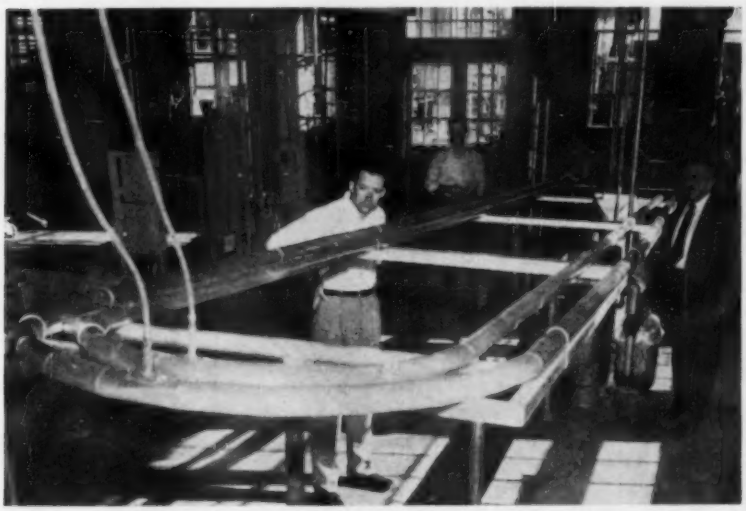
$$(X)^2 = \Delta P_l/\Delta P_g$$

ΔP_l is the pressure drop that would be encountered if the liquid were flowing alone and similarly ΔP_g for the gas. Martinelli et al. correlated their data within an accuracy of +20 and −30 per cent by plotting ϕ versus X. However, since the two-phase pressure drop is assumed to be proportional to ϕ^2 in this correlation, the data are actually within only +44 and −50 per cent. Bergelin and Gazley[6] found that this correlation gives separate lines for each liquid rate, indicating that there was a banding of data rather than a good correlation.

The data presented here also show a banding of points as seen in Fig. 4. It also has been found in this investigation and by others[2,6] that there is a sharp change of slope when a constant liquid-rate line is plotted on $(\phi)^2$ versus $(X)^2$ coordinates. This change of slope corresponds to the transition region between two visually observed flow patterns such as slug to wave of slug to semiannular.

White et al.[12] have presented a correlation for two-phase flow in the region of wave, cresting and semiannular flow patterns. Other investigators[1,2] have classed this region as annular flow. White's correlation is based on a pseudofriction factor (f_w) and a flow ratio (ϕ_w), where the terms are given in the nomenclature.

White was able to correlate his own data within ±18 per cent as well as those of Schneider,[11] Jenkins,[7] and Martinelli.[8] It appears that White's correlation is limited to the pressures and temperatures studied since its development is entirely empirical. Chenoweth et al.[4] have revised and improved Martinelli's correlations for



DOUBLE LOOP of clear plastic pipe adjustable to various inclines is used in the experiment. Fig. 1.

Nomenclature

The following nomenclature is used in the paper:

D = diameter, ft.
f_w = White's pseudofriction factor

$$f_w = \frac{2\, g_c\, D^6\, \rho_l\, \Delta P}{L} \times \frac{W_l + W_g}{W_l^{3.6}}$$

G = mass velocity, based on total cross-sectional area, lb./hour-ft.^{2}
g_c = conversion factor in Newton's laws of motion, (ft.) (lb. mass)/(lb. force) (hour^2)
L = equivalent length of pipe, ft.
ΔP = pressure drop, lb./ft.^{2}
W = mass rate of flow, lb./hour
X = Martinelli's flow modulus, dimensionless
ρ = density, lb./cu. ft.
ϕ_w = White's flow ratio, $\phi_w = (G_l/G_g)^{1.8}\,(\rho_g/\rho_l)^{0.9}\,(1/\mu_g\mu_l)^{0.1}$
ϕ = Martinelli's flow parameter based on gas-phase pressure drop for turbulent-turbulent flow, dimensionless
μ = viscosity, lb./ft.-hr.

Subscripts

g = gas-phase characteristics
l = liquid phase characteristics
TP = two-phase characteristics
w = refers to White's correlation

high pressure but basically at low pressures their correlation is similar to Martinelli's.

Experimental Equipment

The apparatus consisted of a double loop of 1.975-in.-i.d. clear plastic (Tenite) tubing mounted on an angle-iron frame which could be adjusted to various inclines. Orifice and displacement meters, pressure gages, U-tube manometers, and thermometers were used to measure the flow variables. A photograph of the apparatus is shown in Fig. 1. The length of the test loop was 27 ft. and there was 97 ft., 2 in. of straight pipe in the test section. The equivalent length of the test section including bends was found to be 124.5 ft.

Since the pressure surges were very great with slug flow it was necessary to install buffers in the manometer lines to make the readings more stable. The buffers consisted of small surge tanks with the inlet and outlet leads packed with steel wool. The packing technique was difficult to develop since the packing had to be tight enough to lessen the pressure surges but not enough to impair the true manometer reading.

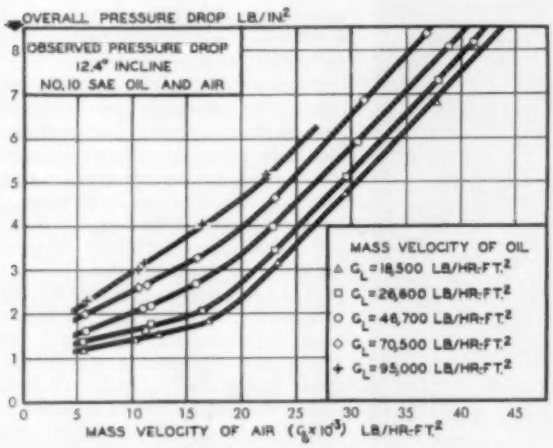
Data were taken using No. 10 S.A.E. lubricating oil or water as the liquid phase and air as the gas phase. The density of the No. 10 S.A.E. oil at 83° F. was 53.9 lb./cu. ft. and its viscosity was 70.4 lb./ft.-hr. During the experimental runs the maximum range of temperature was not enough to affect appreciably the density or viscosity of either the oil or water. The slopes used were 12.4°, 5.5°, and horizontal.

Experimental Results

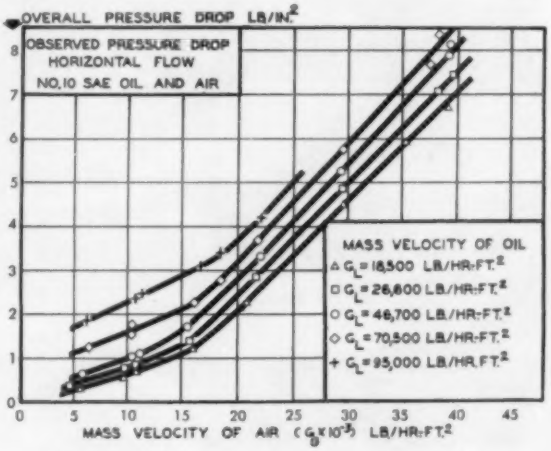
The flow patterns found were similar to those reported by White and other investigators; however, there was one notable exception. The region of stratified flow as recorded by Alves, White, Bergelin, Gazley, and many others did not exist even in horizontal flow. Stratified flow involves a pattern which is characterized by a change in interfacial height along the length of the pipe. A logical conclusion is that if there is any irregularity in a pipe, such as a bend or slight dip, stratified flow will not exist at all and the flow at low gas rates will be slug type. The results of this investigation bear out this conclusion.

Figs. 2 and 3, respectively, show typical pressure-drop data for oil and air at the 12.4° slope and the horizontal position. The plots show overall pressure drop versus air-mass rate in pounds per hour per square foot of open cross-sectional area. The parameters are liquid mass rate in the same units. As might be expected, the pressure drop is proportional to the mass rate of either phase. In general, the mass rate of the gas has a greater influence on pressure drop than has the mass rate of the liquid.

It is interesting to note that there is a change in the flow pattern whenever the air rate exceeds approximately 16,000 lb./hr.-sq. ft. On both graphs there is a definite change in slope which corresponds to this change in flow type. It is also of interest to note that at the lower air rates, the pressure drop is much greater at the 12.4° incline than at the same rate


OVERALL PRESSURE DROP LB/IN.²
OBSERVED PRESSURE DROP
12.4° INCLINE
NO.10 SAE OIL AND AIR
MASS VELOCITY OF OIL
△ G_L = 18,500 LB/HR-FT.²
□ G_L = 26,600 LB/HR-FT.²
○ G_L = 46,700 LB/HR-FT.²
◇ G_L = 70,500 LB/HR-FT.²
+ G_L = 95,000 LB/HR-FT.²
0 5 10 15 20 25 30 35 40 45
MASS VELOCITY OF AIR (G_g x 10⁻³) LB/HR-FT.²

TYPICAL PRESSURE-DROP data are shown for oil and air at 12.4° slope. Fig. 2.


OVERALL PRESSURE DROP LB/IN.²
OBSERVED PRESSURE DROP
HORIZONTAL FLOW
NO.10 SAE OIL AND AIR
MASS VELOCITY OF OIL
△ G_L = 18,500 LB/HR-FT.²
□ G_L = 26,600 LB/HR-FT.²
○ G_L = 46,700 LB/HR-FT.²
◇ G_L = 70,500 LB/HR-FT.²
+ G_L = 95,000 LB/HR-FT.²
0 5 10 15 20 25 30 35 40 45
MASS VELOCITY OF AIR (G_g x 10⁻³) LB/HR-FT.²

PRESSURE-DROP is shown for horizontal flow. Fig. 3.

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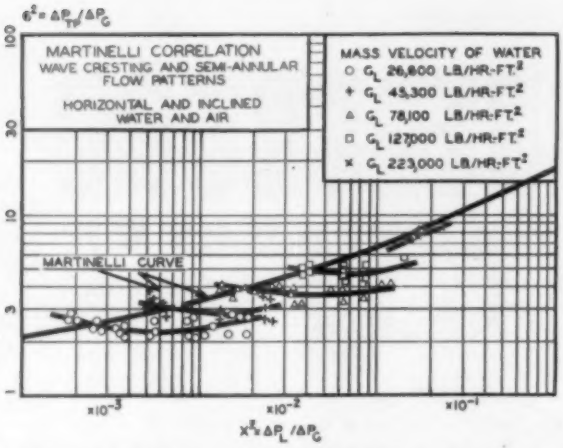
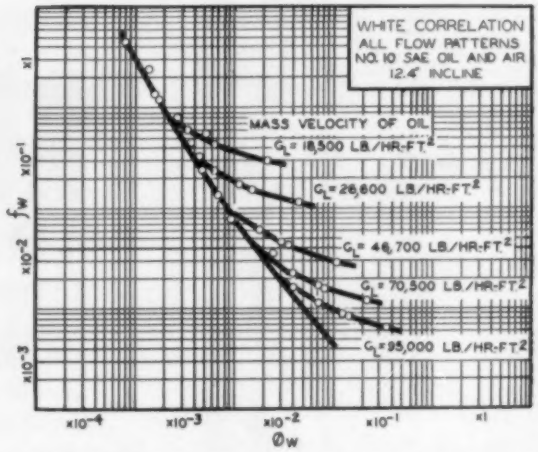


WATER-AIR DATA are plotted for all slopes, using Martinelli's parameters. Oil-air data would appear similar. Fig. 4.



WHITE CORRELATION is shown for oil and air at 12.4° slope. Each separate line is at a constant liquid rate. Fig. 5.

in horizontal flow—greater by as much as three to four times. Since the inlet and outlet pressure taps for the test loop were at the same level, this inequality cannot be due to a change in head, but can only be a result of the irreversible losses in slug-type flow.

In single-phase flow the potential energy head at the top of a rise is regained as pressure energy as the fluid flows downhill, but in two-phase flow the flow pattern changes from slug on the uphill side to stratified on the downhill side and the potential energy is not regained. However, once a steady flow pattern with little pressure fluctuation such as wave, cresting, or semiannular is reached the pressure drops at horizontal and at an incline are identical. These regions are shown in Figs. 2 and 3 at the higher gas rates.

Martinelli Correlation

The water-air data for all slopes are plotted in Fig. 4 using Martinelli's parameters. The oil-air data would appear very similar on this type of plot. This plot of X^2 versus ϕ^2 shows more clearly the reliability of the correlation. Slug and ripple flow are not included since pressure drop in this region is a function of the slope and will not correlate on this plot. Slug flow points merely extend these lines upward to the right at a sharp angle. In fact at the 12.4° slope some recorded pressure drops in the slug flow region are five to six times as great as predicted by the correlation.

White Correlation

Fig. 5 shows the White correlation for oil and air at the 12.4° slope. Each separate line is at a constant liquid rate. The transition of flow type is clearly defined. In the region of wave, cresting, and semiannular flow, the data fall on the correlation but as the gas rate is reduced, the pattern changes to slug flow and the pressure drops are much greater than the correlation predicts.

TABLE 1—COORDINATES FOR WHITE CORRELATION, FIG. 6

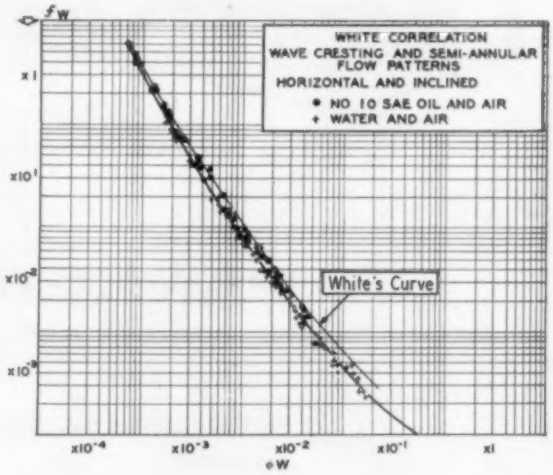
f_w	ϕ_w
6.0	7.1×10^{-4}
3.0	1.04×10^{-3}
1.0	1.95×10^{-3}
6.0×10^{-1}	2.70×10^{-3}
3.0×10^{-1}	4.3×10^{-3}
1.0×10^{-1}	8.9×10^{-3}
6.0×10^{-2}	1.33×10^{-2}
3.0×10^{-2}	2.22×10^{-2}
1.0×10^{-2}	5.1×10^{-2}
6.0×10^{-3}	7.8×10^{-2}
3.0×10^{-3}	1.48×10^{-1}
1.0×10^{-3}	5.6×10^{-1}

Since wave, cresting, and semiannular flow data exhibit the same pressure drop at all slopes, these data were included in Fig. 6 for both the oil-air system and the water-air system. The maximum error for these 155 points is 35 per cent. There is no banding of the data as in the Martinelli correlation. It appears that this correlation is definitely valid at these low pressures for flow at any angle. However, this method is entirely empirical and is not likely to be correct at high pressures. The most important consideration here is that the angle of slope definitely does not affect over-all pressure drop when the fluids are flowing in wave, cresting or semiannular flow. Coordinates for the White correlation are given in Table 1.

Acknowledgment

The authors are deeply indebted to Gulf Oil Corp., Phillips Petroleum Co., and Celanese Corp. which sponsored fellowships in connection with this research.

(See Bibliography at end of discussion, which follows).



CORRELATION is valid for these low pressures at any angle. Fig. 6.

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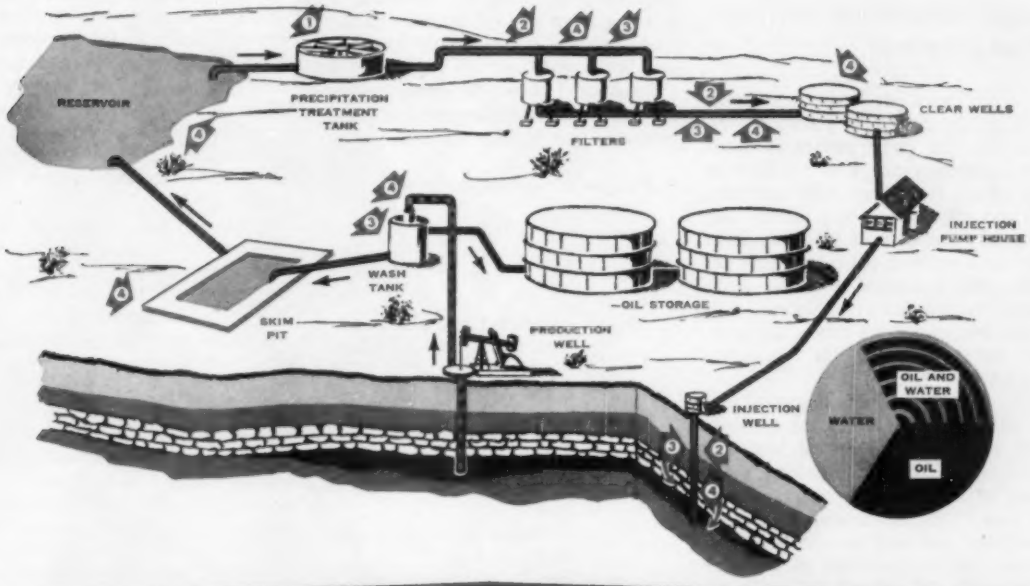

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Discussion of Preceding Article

By Ovid Baker, Magnolia Petroleum Co.

This paper makes possible design calculations for two-phase pipelines . . .

. . . There are many articles in the literature giving the pressure drop of liquid and gas mixtures in horizontal pipelines but it is difficult to find an oil field that does not have hills and valleys in it. Up to this time practically no research work has been done on a method for taking into account the increased pressure drop caused by the hills. Sometimes hills in the line cause 10 times the pressure drop calculated for horizontal flow only.

The authors have demonstrated that the hills do not increase the pressure drop very much except at low gas-flow rates. This has been the experience of the operators of gas-gathering lines in the summertime when gas demand is low and gas flows are reduced. Small quantities of oil produced with the gas which under ordinary conditions flows on into the plant begins to accumulate in the valleys and the pressure drop increases. When gas flows begin to increase with colder weather, this oil usually comes into the plant in big slugs, sometimes straining the plant's facilities to handle it.

Magnolia approach . . . The approach Magnolia has used in evaluating the effect of hills on two-phase pressure drop has been to add an increment of pressure drop caused by hills to the pressure drop we normally expected in a horizontal line.

Equation 1 shows the procedure we have used for evaluating the two-phase pressure drop in hilly terrain.

$$\Delta P_{TPH} = \Delta P_{TP} \text{ (for horizontal pipe)} + \frac{N\,H\,F_e\,\rho_L}{144} \quad (1)$$

ΔP_{TP} = calculated two-phase pressure drop for horizontal pipe, psi.

ΔP_{TPH} = calculated two-phase pressure drop for pipelines in hilly terrain, psi.

N = number of hills

H = average height of hills in feet

F_e = elevation factor from chart or $F_e = 1.61/V^{0.7}$

ρ_L = density of liquid flowing in line, lb./cu. ft.

V = gas velocity in pipeline, ft./second (based on 100 per cent pipe area)

In Magnolia's original paper on two-phase flow we suggested adding a liquid head equal to one-half the height of the hill to the pressure drop calculated by the horizontal flow equation or $F_e = 0.5$. This head should be added for each hill the line goes over.

We looked at this problem as if the gas were having to bubble through a series of manometers. The "holdup" or the amount of liquid in the manometers was the important thing to know. Fig. 1 shows holdup relationship for horizontal pipe. The holdup is a function of the calculated pressure drops of the liquid and the gas assuming each phase flowed in the line alone. Other conditions remaining constant, an increase in gas velocity lowers X and reduces holdup. An increase in liquid flow rate increases X and increases holdup.

It is all very well to know these things qualitatively, but data on inclined-flow holdup and F_e factors were necessary before a line could be designed with confidence.

Several years ago we obtained some data from another company on froth flow in 6-in. pipeline in hilly country. Calculation of some of their froth-flow experimental data indicated that with this flow pattern the pressure drop could be correctly predicted with the froth-flow equation in the article "Simultaneous Flow of Oil and Gas in Pipelines," (OGJ, July 26, 1954). Although there was a total elevation of 982 ft. as the line passed over some 40 hills, there was no effect on pressure drop due to the hills. The line was flowing a mixture of oil and gas and as a part of the experiment, valves were closed simultaneously at each end of the line. Static pressure was then measured between the inlet and outlet of the line, which gave an indication of the amount of liquid holdup in the line. This amount of liquid holdup can be related to the velocity of the gas flowing in the line by the formula:

$$F_e = K/V^{0.7}$$

where:

F_e = fraction of total hill height as liquid head

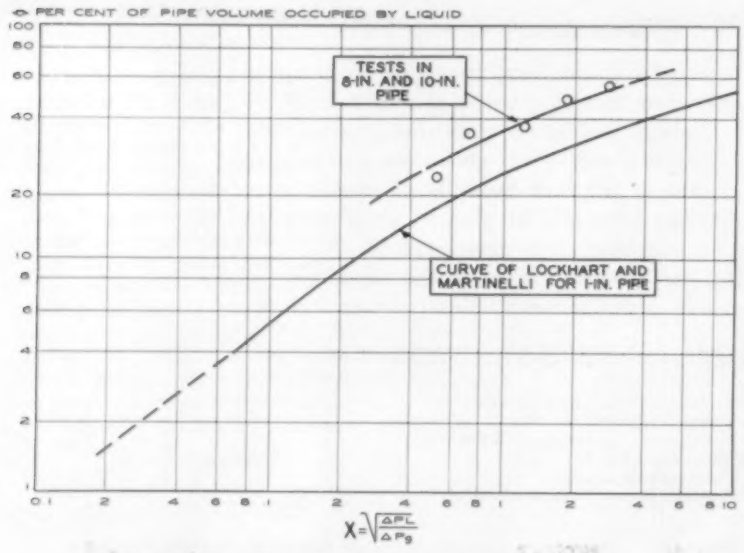
K = a constant

V = velocity of gas in ft. per second

The average value of 1.13 was obtained for K.

Uphill, downhill flow . . . These data lead us to guess that the flow pattern going uphill is froth flow whether or not the horizontal sections of the line are in froth flow. Studies by University of Oklahoma indicate that the uphill flow is very often slug flow while stratified or wave flow occurs on the downhill side.

The authors have covered a gas velocity range from 12 to 80 ft. per



HOLDUP RELATIONSHIP is shown for horizontal pipe. Fig. 1.

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second. Some of Magnolia's two-phase gathering lines have lower velocities than these. The following gas velocities were calculated from operating data on some typical gathering systems:

As a result of the data showing that the liquid holdup in the line was a function of the gas velocity we applied this same idea to a few data from some field tests to determine if velocity would make any difference in the inclined flow correction where we do not have froth flow. These data are shown in Fig. 2. They include two of Mr. Brigham's points, two points from our original paper, and a third obtained recently. Although these data were taken under field conditions and may not be reliable, they result in a very suggestive relationship. The same formula, as shown above, for expressing line holdup in froth flow can be used to predict the height of static liquid head to be added to the calculated two-phase pressure drop for horizontal lines. The only change required is that the constant K would be made equal to 1.61. (Fig. 2).

TYPICAL GAS VELOCITIES IN TWO-PHASE PIPELINES

	Psig.	Bbl. oil per M.M.c.f.	Gas velocity, ft./second
Black oil system	400	2,000	0.5- 5
Casing-head-gas gathering	15	0.1-0.001	2-35
Distillate well stream gathering	1,000	20	2-14
Distillate well stream gathering	1,600	25	4-13
Distillate well stream gathering	3,300	350	1- 3

TABLE 1—AMOUNT OF OIL HOLDUP EXPRESSED AS PER CENT OF HILL HEIGHT WHEN FLOWING IN A FROTH PATTERN IN A 6-IN. LINE IN HILLY COUNTRY

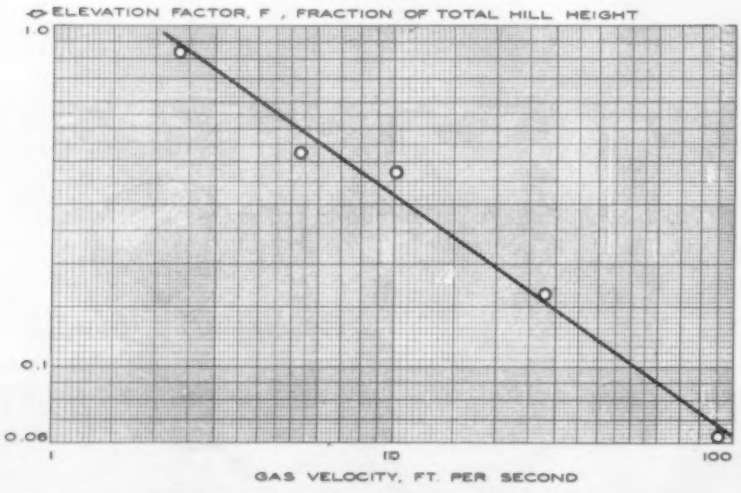
Length of line, ft.	Gas velocity, Ft./sec.	Gas velocity, Miles/hr.	Per cent of hill height	K*	Pressure, psia.	Total height of hills, ft.	No. of hills	Diam. (in.)
100,790	1.5	1.02	79.5	1.06	469	982	40	6
100,790	2.0	1.36	60.6	0.99	427	982	40	6
100,790	2.04	1.39	74.7	1.23	309	982	40	6
100,790	2.4	1.63	70.0	1.29	279	982	40	6
100,790	3.0	2.04	50.7	1.09	313	982	40	6
100,790	4.25	2.89	44.3	1.22	173	982	40	6
100,790	4.75	3.23	34.1	1.02	195	982	40	6
100,790	6.7	4.56	31.0	1.17	146	982	40	6
			Average	1.13				

*Fraction of hill height = $K/V^{0.7}$. V = ft./second.

TABLE 2—GAS VELOCITY VERSUS STATIC LIQUID HEAD AS A PER CENT OF TOTAL HILL HEIGHT FOR TWO-PHASE PRESSURE DROP

Length of line, ft.	Gas velocity, Ft./sec.	Gas velocity, Miles/hr.	Per cent of hill height	K*	Pressure, psia.	Total height of hills, ft.	No. of hills	Diam. (in.)
4,400	2.32	1.59	84.5	1.52	425	110	1	4
132,000	5.26	3.58	43.5	1.39	750	2,430	36	16
25,442	10.2	6.8	38.0	1.92	1,550	262	6	6
120	28	19.0	16.7	1.72	14.7	12	2	2
120	92	62.6	6.4	1.51	14.7	12	2	2
			Average	1.61				

*Fraction of hill height = $K/V^{0.7}$. V = ft./second.



ELEVATION FACTOR, fraction of hill height as a function of gas velocity. Fig. 2.

More research needed . . . Mr. Brigham's data for a liquid mass velocity of 18,000 fall slightly below and parallel to the line shown in Fig. 2. His data for a liquid mass velocity of 70,000 fall higher and parallel. Apparently a fourfold increase in liquid mass velocity causes a twofold increase in F_e. His data suggest that the relationship in Fig. 2 is too simple.

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12. "Horizontal Co-Current Two-Phase Flow of Fluids in Pipe Lines," by P. D. White and R. L. Huntington, Petroleum Engineer, Vol. 27, August 1955, p. 615.

Here's a roundup on what's known about

Corrosion of Oil-Industry Storage Tanks

. . . as determined by a panel from the A.P.I. subcommittee on corrosion. Members of the panel conducted a survey on tank corrosion, and the results are reported in the first section of this report. The second section is a selected bibliography of tank-corrosion articles and abstracts of these articles.

By J. S. Hume, Panel Leader
Continental Oil Co.

SEVERE corrosion in the vapor zone of tanks is not necessarily a function of sulfur content, as examples of severe corrosion were reported wherein the stored crudes and distillates contained sulfur over the wide range of 0.02 to 3.0 per cent. Vapor-zone corrosion is considered to be severe if major repairs are necessary within 10 years or less.

The corrosivity of vapors is usually predicted from previous experience, including inspection records and occasionally coupon testing. One company predicts severity of corrosion on the basis of the H_2S content of stored materials. The chief corrodents are H_2S, water, and oxygen. Factors which increase the concentration of these corrodents tend to increase corrosion severity.

Fixed roofs . . . Reports from 9 companies indicated a combined total of 200 to 300 tanks suffering severe corrosion. The tanks ranged in size from 500 to 210,000 bbl., and all the fixed-roof tanks were of the cone-roof type.

The roof, top shell, and structural-member life of tanks in severe corrosive service varied widely. The average life for each item was: roof, 7 years; top shell rings, 25 years; and structural members, 20 years.

In the case of tanks connected to a vapor - conservation system, severe vapor-zone corrosion was reported for only three tanks; hence, either few tanks are connected to conservation systems, or else conservation systems are effective in mitigating vapor-zone corrosion.

Materials of construction . . . Aluminum, galvanized steel, copper-bearing steel, and wrought-iron roofs have been used in corrosive services. In most cases, the users of the materials do not think that they have enough data or experience with the materials to judge their relative merits.

Aluminum roofs cost about two to three times as much as carbon steel roofs, and some have been in sour-stock service for 20 to 23 years. Aluminum roofs usually fail where the aluminum contacts with steel or iron sulfide. This emphasizes the need to insulate or design away from aluminum-steel contacts.

Protective barriers . . . Gunite-applied concrete linings last at least 15 to 20 years and cost about $1.00 per square foot. Plastic coatings cost about 20 to 50 cents per square foot and last 2 to 5 years. Several companies are testing a number of plastic coatings which appear promising. Zinc-dust silicate coatings appear most promising for combating tank-shell corrosion in floating-roof tanks.

Chemical treatment . . . Ammonia introduced into the vapor zones of tanks has produced varied results. Apparently NH_3 is not effective once a sulfide scale has formed on the vapor-zone surfaces of the tanks. A sulfide scale does occur eventually on new steel surfaces even in the presence of ammonia.

No reports were received on the effect on vapor-zone corrosion of a caustic or neutralizing treatment of stocks previous to storage; however, caustic washing of distillates from sour crudes has effected an increase of 5.4 years in the average life of tank roofs in rundown and intermediate storage service in previously reported work.

Floating roofs . . . Floating roofs last longer than cone roofs in similar service; however, few comparative data were reported. Except for a few pan-type roofs, only pontoon roofs were reported on; consequently the relative merits of different types of floating roofs could not be established.

Only two instances were reported where floating-roof tanks were used to replace cone-roof tanks as a corrosion-control measure rather than primarily as a conservation measure.

A number of floating-roof tanks in light-product service are experiencing severe tank-shell corrosion by the action of the metal shoes removing semiprotective rust layers and exposing fresh metal to corrosion.

Miscellaneous measures . . . Several companies reported the use of microballoons to reduce vapor losses. No one has been using microballoons long enough to determine their effect on vapor-zone corrosion.

Increasing corrosion allowances of carbon-steel roofs has in some cases proved profitable.

The blanketing of cone-roof tanks with sour and sweet gases to exclude oxygen in the vapors has been effective in eliminating vapor-zone corrosion, provided oxygen concentration is kept below 1 per cent by volume.

Published Information on Storage Tanks

. . . a selected bibliography and abstracts of these important articles

GROUP 1

Articles covering several aspects of storage tank corrosion

E. Q. Camp, Humble Oil & Refining Co., Corrosion Prevention in Processing Sour Crudes, Corrosion, 8, No. 6, 371-398 (1948).

CORROSION of steel tanks in sour crude and sour distillate service is caused by action of hydrogen sulfide, oxygen, and water. Roofs and top two shell rings usually suffer the most corrosion.

The roofs of tanks in sour-crude service have a life varying from 5.3 to 11.6 years. Roofs of tanks in sour distillate service have a life of 3.8 to 14.3 years. Means of increasing life of tanks are discussed.

. . . **Heavier steel construction.** The use of $\frac{3}{16}$-in. roof material could probably be justified for use on rundown tanks and tanks of intermediate size in sour service where the previous roof lasted less than about 6 years, whereas ¼-in. material would probably be more practical on larger tanks.

. . . **Roofs of aluminum and galvanized steel.** No corrosion on roofs proper has occurred on 27 aluminum roofs in sour-distillate service installed between 1928 and 1936. Galvanic corrosion has been experienced where roofs are riveted to angle irons connecting the roof to the shell and where roofs contact with steel supporting members. This type of corrosion has necessitated extensive repairs on several tanks, particularly near the angle irons.

Two rundown tanks were equipped with galvanized roofs in 1930. Some galvanic corrosion has occurred where the roofs contact with angle iron and structural members, but the tanks are still in good condition.

The conclusion is given that since steel roofs can be protected at a relatively low cost by gunite lining, steel roofs should be used instead of aluminum or galvanized roofs.

. . . **Caustic washing** of distillates from sour crudes has effected an increase of 5.4 years in the average life of tank roofs in rundown and intermediate storage service.

. . . **Oil wetting flat roofs in crude service.** Spray systems have been installed in some tanks whereby crude may be sprayed at regular intervals on the roof and the top shell plates, thereby maintaining a protective oil film on these surfaces.

Indications are that this practice has increased tank life, but it is not conclusive at present that this type of protection is economically feasible for general application.

. . . **Floating roofs.** The statement is made, without elaboration, that experience indicates floating roofs are an effective way to eliminate the problem of corrosion of tank roofs in sour-crude service.

. . . **Protective coatings.** A wide variety of nonmetallic coatings was tested on steel panels. The most promising materials were applied to roofs of tanks in sour service. None of the materials tested have given satisfactory protection for as long as 2 years.

. . . **Gunite linings.** Because of satisfactory results, it is now common practice to gunite the inside surface of essentially all tanks in rundown and intermediate sour-distillate service. Gunite is applied on the roofs to a 1-in. minimum thickness over reinforcement and a sandblasted surface.

Reinforcement consists of 10-gage steel wire, 3 by 3 in., tied to ¼-in. rods tack welded on 15-in. centers. Structural members are also covered with wire mesh and coated.

Gunite lining consists of three parts sand and one part cement and is usually applied at a cost of 50 to 60 per cent of cost of a new tank, using a type N-1 cement gun. It is expected that gunite lining will more than double the life of a tank. Maximum life has not been established.

H. F. McConomy and J. J. Hur, Atlantic Refining Co.—Economics of Metals and Coatings to Combat Corrosion of Refinery Tank Roofs. Proc. A.P.I. Vol. 32M(III), p. 67-71 (1952).

AN EVALUATION of the expenditure incurred by the replacement of steel refinery tank roofs destroyed by internal corrosion includes: (1) tank cleaning costs, (2) preparation and miscellaneous maintenance, (3) repairs to roof or application of coating, (4) company overheads, (5) down time, and (6) rate of return (or interest) on additional investment.

Materials chosen for comparisons were bituminous-base and organic resin-base protective coatings on $\frac{3}{16}$-in. steel plate, heavier ¼-in. steel plate, galvanized $\frac{3}{16}$-in. steel plate, and $\frac{3}{16}$-in. aluminum plate. Tables, results, summary, conclusion, and three references are included.

Newcomb, Dixon, and Kelley, Standard Oil Development Co., The Texas Co., Humble Oil & Refining Co.—Corrosion Protection of Storage Tanks. Proc. A.P.I. Vol. 23(III), p. 38-50 (1942).

FOR A NUMBER of years, extensive work has been carried on in developing methods of corrosion protection for steel storage tanks. Galvanized roofs have shown a life double that of plain steel for less than double the cost. Galvanized tanks in small sizes have shown merit.

Aluminum roofs have given good service but are costly, particularly when aluminum rafters are used. Various coatings, including aluminum and lead foil, paints, enamels, synthetic resins, etc., generally have been unsatisfactory, although they afford some protection for a short period.

The use of outside rafters on small tanks has resulted in reduced replacements costs. Concrete has been employed for many years as protection for various parts of tanks.

Successful methods of applying reinforced gunite linings are described and illustrated. Gunite has been applied successfully when the tank was in such corroded condition that replacement was the only alternative. Costs per square foot are 40 cents for roof and structural members and 37½ cents for the shell.

The use of unreinforced gunite lining for protection of floating-roof tanks is also described.

R. A. Brannon, Humble Pipe Line Co., Internal Corrosion of Crude-Oil Tanks, Proc. A.P.I. Vol. 28(V), p. 57-60 (1948).

IN THE CASE of vapor-space corrosion, most protective coatings have proved to be of doubtful value; and additional development work needs to be done by manufacturers of coating materials, applicators of these materials, and the tank owners.

Some use is being made of aluminum as a substitute for steel in the

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construction of tank roofs and roof-supporting structures. Advancing steel prices have encouraged the use of aluminum, and it appears likely that considerably more use will be made of it in the future.

Probably the most satisfactory and economical method of preventing this corrosion has been the use of gunite coatings for tanks. These coatings can be successfully applied to tank roofs, shells, and bottoms.

Floating roofs are also used to reduce corrosion because they practically eliminate the vapor spaces. It is understood that additional methods of corrosion control, such as modification of tank construction and use of inhibitors or neutralizers, are being developed.

Shaffer and Pollack, Humble Oil & Refining Co.—Corrosion in Nonpressure Refinery Equipment. Proc. A.P.I.(III) p. 63-70 (1932).

IN THE CASE of crude, rundown, and intermediate services, tank roofs suffer the most corrosion. Corrosion is caused by H_2S, moisture, and air.

Crude-tankage roofs usually last 4 years or more. Rundown-tank roofs average 6 to 7 years, but their life ranges from 3½ to 10 years. On intermediate storage for cracking stocks and gas oils, roofs last from 2½ to 6 years or more.

Brief mention is made of the use of aluminum and galvanized roofs, paint coatings, and caustic-washing stocks to control the vapor-space corrosion occurring in refinery storage tanks.

The Texas Co. Corrosion Report, 1952, Tank Corrosion—Interior. The Oil and Gas Journal, p. 213, March 17, 1952.

IN EXCERPTS from The Texas Co. Corrosion Report, 1952, on interior tank corrosion, several methods of corrosion control are mentioned. In the case of coatings, gunite is reported to be most efficient and expensive. The so-called plastic coatings generally fail in a period of 2 years. Galvanizing is said to offer little protection in sour-crude service and is very expensive.

Aluminum decks and rafters appear to give very good service. Ammonia when introduced in vapor space seems to form an inhibitor which prevents corrosion in that area.

D. A. Shock and J. D. Sudbury, Continental Oil Co.—Corrosion Environment and Methods of Mitigation in Producing Sour Crudes. Petr. Engr., p. B-42, June 1950.

A SHORT discussion of several methods of mitigating corrosion occurring in the vapor space of storage tanks is presented. Corrosion-control methods reviewed are: coatings, metal alloys and design, vapor-space inhibitors, and minimizing corrosion by operating practices.

The latter method includes oil wetting exposed surfaces by sprays and maintaining a natural gas blanket to exclude air.

Report of A.P.I. Committee of Refinery and Marine Corrosion—Corrosion of Tanks. Proc. A.P.I. (III), p. 100 (1930).

A BRIEF summary is presented of various methods of corrosion control in refinery storage tanks. The methods mentioned are floating roofs, balloon and breather-type roofs, paint coatings, aluminum foil applied with adhesive, galvanized steel, aluminum sheets and rafters, and copper-bearing steels.

The current status of each method is discussed. No final conclusions are made.

L. R. Gray, Shell Oil Co.—Processing of West Texas Sour Crude. Petr. Ref. (23) (10), p. 108 (1944).

VERY BRIEF mention is made of storage-tank corrosion. It is stated that the corrosion rates for storage tanks handling West Texas reduced crudes and cracked residues are 2/64 to 3/64 in. per year for roof plates and 1/64 in. per year for side plates.

GROUP 2

Articles covering specific aspects of storage-tank corrosion

COATINGS AND LININGS

J. S. Cook, Humble Oil Co., Internal and External Protection of Storage Tanks, Proc. A.P.I. Vol. 32M(III) p. 72-83 (1952).

PNEUMATIC application of concrete mortar (gunite) on internal surfaces of tanks for corrosion protection has been practiced since 1933 by Humble Oil Co. Installation costs vary with local conditions, size of tank, amount of surface to be protected, number of columns, circular girders, knee braces, etc.

Some jobs cost up to 90 per cent of a replacement in kind with steel. The average cost is 75 per cent, and some are as low as 50 per cent. The ultimate life of a properly applied gunite liner in sour crude or distillate service is estimated to be 20 years.

A.P.I. Standards 12-A and 12-C are used in computing tank stresses. In most cases, the corroded tank roof and girders have sufficient strength left to support the additional load imposed by the gunite lining.

Utilities necessary in conjunction with a gunite job are: (1) compressed air at 90 psi. and 300 cu. ft. a minute; (2) steam at 150 psi. for jet cleaning, removal of rebound, and maintenance of effective curing temperatures during cold weather; (3) alternating current for welding machines, usually 3-phase, 60-cycle, 110-volt; and (4) water for cleaning the tank and preparing gunite mix.

Properly prepared and mixed gunite is applied in thicknesses of 1 to 1¼ in. over 3 by 3-in. by 10-gage plain steel mesh. The mesh has been tied securely to ¼-in.-diameter deformed reinforcing rods spaced on 18-in. centers and tacked every 18 in. to the shell.

"Petroleum Processing" Staff—Corrosion Protection for Tanks by Reinforced Gunite Lining. Petr. Proc. p. 784-788, July 1949.

This describes in detail gunite protection as applied at the Humble Baytown refinery. The tank is gas-freed, and the interior surface hosed down and inspected from a portable scaffold. If the measured corrosion rate indicates a service life of less than 10 years, gunite protection is usually considered justifiable.

Work on the roof and shell is performed on a floating raft. Description of the raft is given. A sectional drawing and photograph of a type N-1 gunite machine with parts list are included. A gunite machine is used for sandblasting as well as gunite application.

Procedure and specification for installation of reinforcement are presented, including photographs. Tables are included that show the required man-hours and materials for sandblasting, reinforcing installations, and

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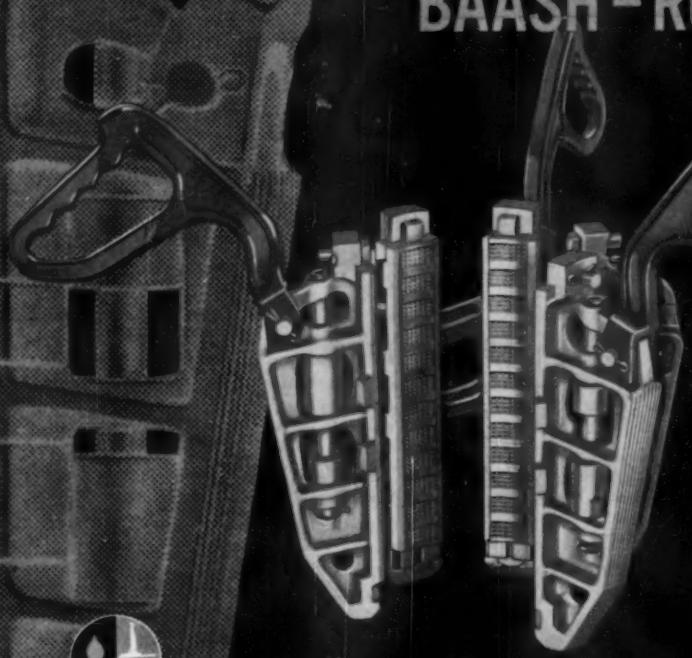

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Ammonia in concentrations as low as 0.4 per cent in systems containing 2 per cent H_2S by volume is effective in controlling vapor-zone corrosion

gunite application for tanks 60 and 117 ft. in diameter.

The composition of gunite mixture is discussed. A rebound loss of 30 to 35 per cent is experienced in applying gunite to roof and shell. Curing the gunite is usually performed by spraying the gunited surfaces with water at 2-hour intervals for the first 48 hours, and 72 hours usually elapse between completing the gunite application and placing the tank in service.

W. J. Clayton, Minnesota Mining & Manufacturing Co.—Effective Use of Vinyl Coatings in Control of Oil-Tank Corrosion. Pipe Line News 21, No. 10, 36-7 (1949), Nov., Paper, N.A.C.E., Midland, Tex.

EFFECTIVE use of vinyl coatings in the control of oil-tank corrosion requires a practical, safe, and economical method of metal preparation and coatings which have been properly plasticized to withstand the embrittling effect of oil or other leaching agents.

The advantages and defects of oil-based and phenolic resin-nitrile rubber primers for vinyl coatings on partially cleaned steel surfaces are discussed. "Wash primer," a combination of vinyl resin, zinc chromate, and phosphoric acid solution, has eliminated the necessity of sandblasting in many cases.

Vinyl-polysulfide rubber and blends of nitrile rubber with vinyl chloride-vinyl acetate gave excellent oil-resistant coatings. Florida tide range test for determining the corrosion resistance of vinyl-coated steel plates is correlated with conditions existing in sour crude tanks.

W. B. Cook, Gulf Oil Corp., Interior Tank Corrosion. The Oil and Gas Journal, p. 313, March 17, 1952.

GULF'S records indicate that uncoated, large (80,000-bbl.) sour crude storage—working tanks, will develop small holes in the roof from interior corrosion after 2 to 3 years' service which may be patched occasionally to extend life to 5 years. Uncoated roofs in sour-distillate service rundown tanks must be renewed after periods of 3 to 4 years.

Cost-durability studies made in 1948 showed that coal-tar and air-dried phenolic coating systems applied to vapor-space interiors of sour distillate rundown tanks were not economically advantageous.

A four-coat vinyl system in one application in a distillate tank service gave 4½ years of 95 per cent protection. A five-coat vinyl system in another application provided 2 years' protection. Five-coat vinyl systems are being tried in other tanks.

CORROSION INHIBITORS AND NEUTRALIZERS

F. T. Gardner, A. T. Clothier, and F. Coryell, Carter Oil Co.; Carter Oil Co., and Interstate Oil Pipe Line Co., The Use of Ammonia in Control of Vapor-Zone Corrosion of Storage Tanks, Corrosion Vol. 6, No. 2, p. 57-65 (1950).

LABORATORY studies have shown that ammonia in concentrations as low as 0.4 per cent in systems containing 2 per cent H_2S by volume is effective in controlling vapor-zone corrosion.

Results of experimental field work with 55,000-bbl. tanks showed that the efficiency of protection gradually increased from 16 per cent when an inhibitor injection rate of 1.4 lb. a tank a day was used to almost complete protection when 12 to 15 lb. a day were added to the tank vapor zone. The uninhibited corrosion rate measured simultaneously in tanks in similar service averaged 53 m.p.y. for the entire test period.

Interstate Oil Pipe Line Co. is now using ammonia in treating eight tanks at three pipeline stations, three tanks at the Magnolia station in southern Arkansas, and two at the Moore station in northern Louisiana, and three remaining tanks under treatment being at the Yellowstone station near Billings, Mont.

Ammonia usage is economical and is equally effective in both areas despite the great differences in climatic conditions.

A. H. Newberg and J. P. Barret, Service Pipe Line Co. and Stanolind Oil & Gas Co., respectively—Vapor-Zone Corrosion in Sour Crude Tanks. The Oil and Gas Journal, p. 189-192, November 15, 1954.

VAPOR-ZONE corrosion in sour-crude tanks can be controlled by design, use of resistant materials, inhibitors, or coatings, either separately or in combination. No one method has proved completely successful. Authors believe that considerable progress can be made in the field of inhibitors.

Several available materials have shown promise but are not generally satisfactory at present. The use of coatings is most attractive economically; however, the manufacturer should be more critical of the materials submitted for use. Rigid inspection of every phase of a coating job by trained inspectors is a necessity for satisfactory performance.

Authors believe more effort should be expended toward the development of both improved application techniques and coating materials having a greater tolerance for imperfect application.

Walter F. Rogers, Gulf Oil Corp.—A Note on the Value of NH_3 Treatment for Tank and Casing Annulus Corrosion by Hydrogen Sulfide, Corrosion, Vol. 11, No. 11, pp. 42-45 (1955).

THE USE of sufficient ammonia in the vapor space of sour-crude tanks to develop pH values in the condensed water of 9.5 to 11.5 will, if the steel tank is initially free of iron sulfide, result in 90 per cent or more protection from 4 to 8 months during which time a corrosion product of iron sulfide develops.

After the development of a coating of iron sulfide of difficult polarizable characteristics, the use of ammonia will not significantly retard the corrosion rate. If a coating of iron sulfide is present on the steel when ammonia treatment is initiated, the treatment will not significantly retard the corrosion rate.

L. W. Jones and J. P. Barrett, Stanolind Oil & Gas Co. (now Pan American Petroleum Corp.)—New Inhibitor Safeguards Vapor Spaces Against H_2S Corrosion. The Oil and Gas Journal, p. 132-137, September 24, 1956.

VARIOUS cyclic and aliphatic amines have been laboratory tested for effectiveness as volatile corrosion inhibitors in vapor spaces. The tests were designed to find an inhibitor capable of reducing corrosion occurring in the upper gas-filled vapor-space portion of the tubing-casing annulus of wells producing sour crude oil and gas.

The corrodent is acidic solutions of H_2S and CO_2 dissolved in condensed water under anerobic conditions in the upper tubing-casing annulus. Laboratory tests were conducted under simulated sour-well conditions.

Diethylamine at 50 p.p.m. concentration appears promising and is being

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field tested. The authors imply that the inhibitor should be useful in combating vapor-zone corrosion in sour-crude storage tanks.

CORROSION MECHANISM

D. C. Bond and G. A. Marsh, Pure Oil Co.—Corrosion of Wet Steel by H_2S Air Mixtures, Corrosion Vol. 6, No. 1, p. 22-28 (1950).

INFORMATION concerning the initial rate of corrosion and nature of corrosion products formed by the action of H_2S-air mixtures on wet steel is presented. This information should be applicable to a fundamental study of the corrosion occurring in the vapor space of tanks used for storing sour crude oil. Laboratory apparatus and procedures used in making corrosion tests are described and illustrated.

Conclusions were:

1. For mild steel, the most corrosive H_2S-air mixture consists of about 1 per cent H_2S in water-saturated air.
2. At H_2S concentrations of about 10 per cent, the corrosion rate increases about 20 per cent when the temperature is increased from 70° to 120° F.
3. The corrosion rate under the conditions tested is independent of time, at least during the first several hours of exposure.
4. Analysis of the corrosion products reveals a fairly uniform increase in per cent sulfide with increase in H_2S concentration. Free sulfur is present even at high H_2S concentrations.
5. The oxidation of wet ferrous sulfide is 85.5 per cent complete after 4 hours' exposure to air at 120° F. Ferrous sulfide as prepared in the experiments did not ignite spontaneously in air.
6. The conversion of hydrated iron oxide to iron sulfide (in presence of H_2S) proceeds faster than the conversion of iron sulfide to iron oxide (in the presence of air) under the conditions used in the experiments.

Scott P. Ewing, Carter Oil Co.—Electrochemical Study of the Hydrogen Sulfide Corrosion Mechanism. Corrosion Vol. 11, No. 11, pp. 51-55 (1955).

A STATEMENT of the anodic and cathodic reactions in the hydrogen sulfide corrosion process is given along with experimental evidence to indicate that these reactions are the important ones. The corrosion process is explained further in terms of the electrochemical properties of the corroding solutions and the corrosion products.

Results of laboratory experiments indicate that the description of the mechanism is correct. The possible usefulness of an understanding of the corrosion process is explained.

PLASTIC MICROBALLOONS AND BLANKETS

Staff, The Oil and Gas Journal—Plastic Blanket Checks Vapor Loss. The Oil and Gas Journal, p. 126, April 23, 1956.

BRIEF mention is made of a new floating plastic blanket of unplasticized polyvinyl chloride. It has been used in France to reduce vapor losses, 80 to 90 per cent, from storage tanks containing crude and refined products and chemical solvents. Standard Oil Co. of Ohio is currently testing the blanket in two storage tanks.

W. A. Keutgen, Bakelite Co.—Microballoons Live Up to Promise. The Oil and Gas Journal, pp. 91-92, November 26, 1956.

REDUCTIONS in crude-oil evaporation of 50 to 80 per cent have been reported by four companies using a microballoon sealing foam in cone-roof working tanks. In three cases, the installations have been in operation for more than 2 years. The plastic microballoon spheres are pumped into the tanks as an oil-balloon mixture by means of an aspirator.

The sealing foam layer is usually ½ to 1 in. thick and costs about one-sixth the price of a floating roof. The effect on vapor-zone corrosion is not reported.

GROUP 3

Articles with primary emphasis on storage tank design and materials of construction

C. V. Lynn, Sinclair Refining Co., Protect Your Tank Investments. Petr. Proc., p. 361, March 1955.

THIS PRESENTS data and charts on estimating proper retirement age for oil storage tanks. Rigorous analysis should be made before installing floating roofs in old riveted shells.

Riveted shells are difficult to keep tight and painted. The rivets hinder operation to some extent and increase maintenance on roof seals, and more evaporation losses occur than in a smooth shell.

Graphs of tank costs per barrel by type of roof and total estimated cost of tanks, by type, are included.

R. M. Carter, Service Pipe Line Co., Crude-Oil Working Tanks. Petr. Engr., p. D-32, January 1953.

PRESENCE of hydrogen sulfide in crude-oil vapor, even in low concentrations, causes very rapid corrosion of continually exposed steel surfaces of working tanks. This vapor-exposed surface should have a protective coating at the time interior coatings are applied to other parts of the tank.

Galvanizing is an effective method of protecting the sealing-ring sections or shoes. Small pivot and cotter keys should be of stainless steel.

E. E. Kerns and W. E. Baker, Standard Oil Co. (Ohio)—Use of Aluminum in Petroleum Refinery Equipment. Proc. A.P.I. 31M(III), pp. 89-98 (1951).

THIS ARTICLE contains a table showing disposition of 27 aluminum roofs in rundown-tank service. Service history is included to 1950. The stock handled, age, number of years before repairs were needed, years before reroofing, and years before dismantling are presented for each tank.

Fred L. Plummer, Hammond Iron Works—Use of Aluminum in the Petroleum Industry. Petr. Refiner, Vol. 28, No. 10 (1949), p. 97-106.

A DETAILED discussion of the design of aluminum roofs for storage tanks is presented. Methods to prevent galvanic action between aluminum and steel are given. Detailed aspects of designing aluminum roofs for bolted, riveted, and welded construction are covered.

Proper choice of aluminum alloys for plate, rivets, and structural members is discussed. Included, also, is a detailed treatment of field welding of aluminum roofs.

E. N. Zimmerman, Chicago Bridge & Iron Co.—Evolution of Oil Tanks. Petr. Engr., p. A-43, December 1952.

THIS contains historical information about storage-tank development. Vapor-space corrosion is not discussed; but all types of storage tanks are reviewed, and numerous photographs of different types of tanks are included.

L. J. Cogan, Graver Tank & Manufacturing Co.—Tank Construction for Product Storage. Petr. Engr., p. A-76, December 1952.

BRIEF mention is made of the use of floating-roof-tank construction for the storage of sour crude oil or distillates.

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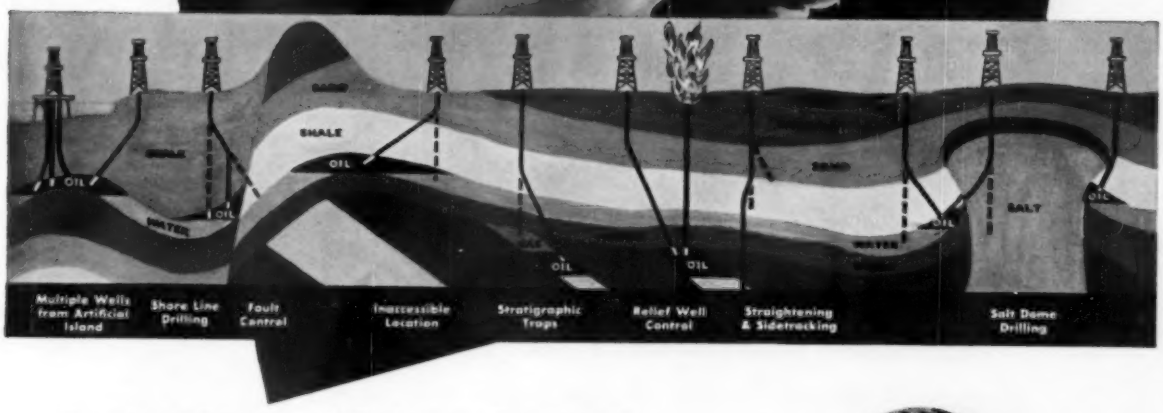

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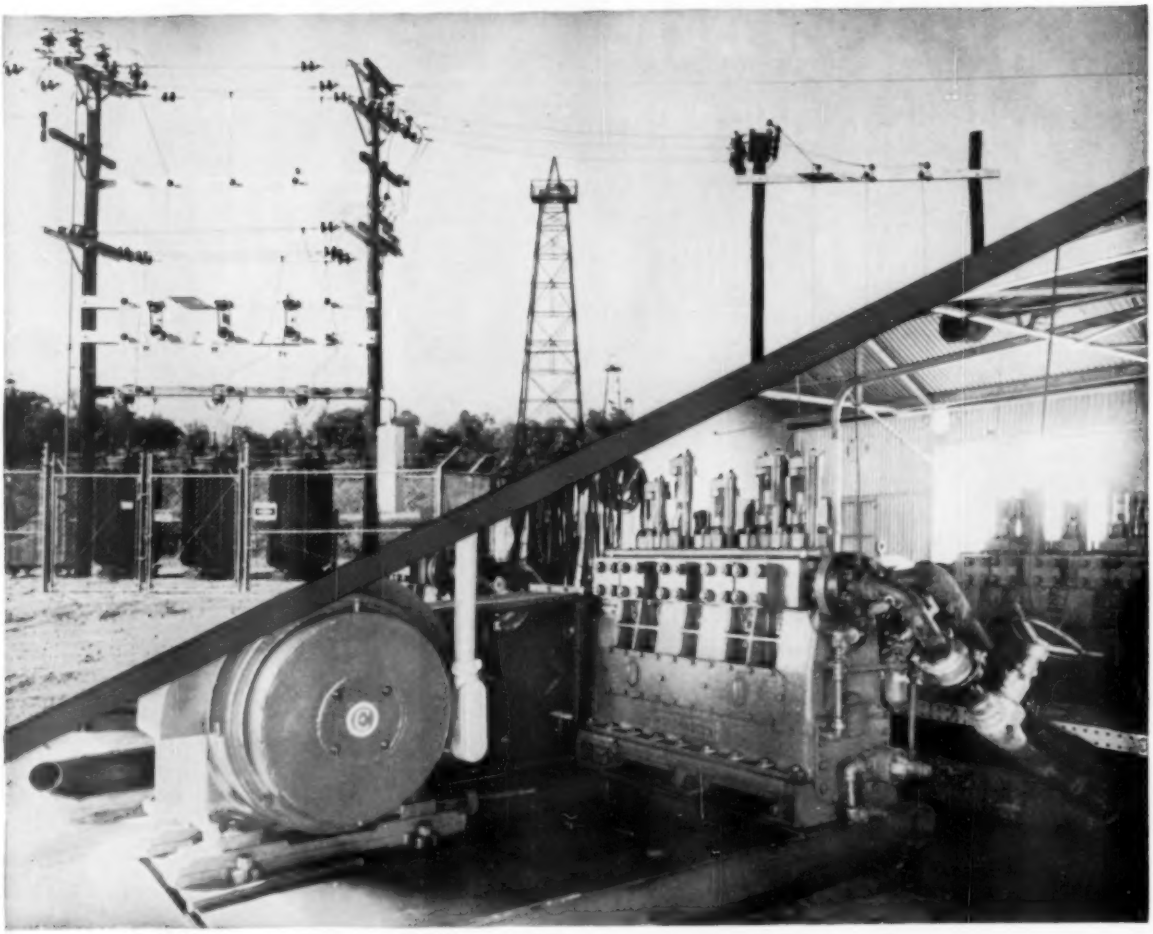

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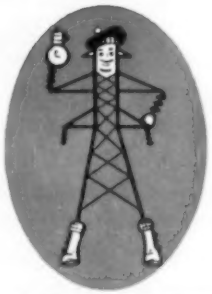

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Tracers in cement help find water leaks in wells

Use of magnetic solid along with tracer simplifies the analysis

By D. H. Stormont
District Editor

TRACERS added to cement used during completion and remedial work are proving to be a rapid, low-cost means for determining the source of water entry into oil and gas wells.

Basis for the method is quite simple. Water moving over a cement surface, or any other surface, will erode away minute particles of material. These can then be identified by microscopic analysis.*

If water enters a well from behind cemented casing or through a bottom plug to which a tracer has been added, microscopic particles of the additive will be picked up. Through use of a different tracer in each type of cement job, source of the leak can be readily pinpointed.

If no tracer is found present when the water is studied under the microscope, it can be concluded the water is from the producing formation.

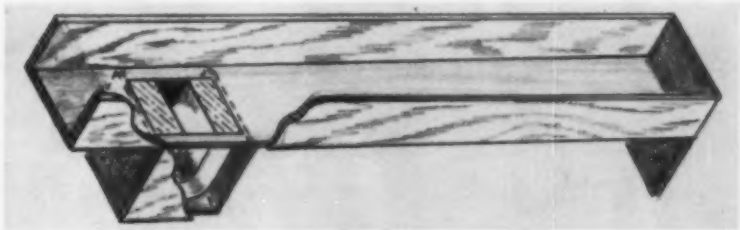
All that is required for the determination is a sample of water from the flow line. The analysis often can be made at the well site without any delay. It is not necessary to shut in the well, or to call a service crew to the site to determine the source of water supply.

When the method (called Aquatrace) was first introduced in 1953, microscopic analyses were carried out solely for cement particles (OGJ, June 22, 1953, p. 147). From their presence, or absence, formation waters were successfully differentiated from that resulting from a leaky cement job. But numerous samples had to be viewed through the microscope in order to make a positive determination. Likewise it was not possible to determine which cement job had failed.

Addition of tracer materials simplified the process since they are more readily identifiable than cement particles. It was still necessary, however, to examine numerous slides to assure that none of the tracer was present.

The most recent improvement, use of a magnetic solid along with the tracer, greatly simplifies the analysis. By running the water through a magnetic field, practically all of the magnetic tracer contained in a 5-gal. (or 1-gal.) sample is concentrated on the pole surfaces. If there is no deposit it can safely be assumed the water is formational.

*Process is covered by U. S. letter Patent No. 2660887, issued to Dr. Frederick Frei, Santa Monica, Calif.



CAPTURING IDENTIFIABLE TRACER particles is accomplished by passing the water sample through a magnetic field at the bottom of an inclined trough. Fig. 1.

A B

TRACER MATERIALS as seen through a microscope. In additive A, a perlitic type, most of the particles are larger than the diatomaceous type shown in B. The larger spherical particles represent the magnetic solids added to trap the nonmagnetic additive. Fig. 2.

Addition of tracer . . . As mentioned earlier, each tracer is composed of two ingredients: (1) the specific identifiable tracer, and (2) another fine solid which is magnetic. Purpose of the latter is to aid in capturing as many identifiable particles as possible so that detection of the tracer is greatly facilitated.

Materials used as tracers must fulfill three requirements. First, they must be foreign to the sediments in the well bore. Second, they must be solids which will not dissolve in any oil-well fluid, and are identifiable at all times. Third, they should not impair the setting time, strength, or other desired properties of the cement.

Regarding the last named, tests have shown that only 2 or 3 per cent of tracer material is sufficient for identification purposes. Use of up to 10 per cent did not change the strength or setting time of the cement, it was determined.

In the jobs performed to date, 5 per cent (by weight) of tracer has

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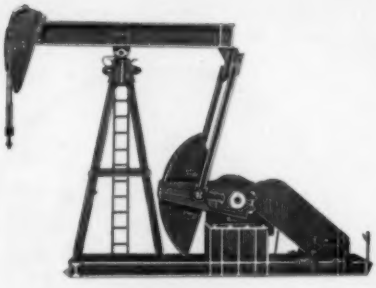

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been added to the cement. In some cases this resulted in 1,500 lb. of tracers being used in casing-shoe jobs. In setting bottom plugs, scabbing off intermediate water zones, and in squeeze jobs much smaller quantities generally were used. The additives either were intimately mixed with cement at the well site or premixed at the bulk plant.

Three types of tracers are available, and others soon will be. This enables a different type to be used for each of three jobs. For example, one type could be used in the bottom plug, a second for setting the casing, and a third for squeeze jobs. Water from subsequent leaks in any of these jobs could be traced readily because of the tell-tale additive.

Analysis procedure . . . Whenever a well in which Aquatrace has been used starts producing excessive water, a sample is obtained from the flow line or wellhead. A 1-gal. sample of fluid may produce sufficient tracer to make a positive determination but a 5-gal. sample usually is desirable. Care is used to use clean containers in order to avoid contamination.

Where good samples are obtained they can be concentrated in the field. Where the fluid consists of heavy oil and water, thick emulsions, or water with drilling mud, they sometimes must be processed in a laboratory before the concentrate can be analyzed under the microscope.

Concentration is accomplished by slowly running the sample down a small trough lined with fine-grained paper (see sketch). As the fluid gravitates toward the open end of the trough it passes through a magnetic field created by a strong C-shaped magnet provided in a recess beneath the paper. All the fluid passes within close range of the magnetic force so that most tracer particles present in the fluid will concentrate above the poles.

Absence of any concentration around the edges of the poles indicates the source of water is formational. No laboratory microanalysis is necessary.

If a dark pattern forms above the poles it is due to one of two factors: Deposition of tracer material, or iron particles from either the well equipment or formation. Dark oil will obstruct visibility but it can be restored by washing the pole area with a solvent such as kerosine.

Microscopic examination . . . Any solids collected in the magnetic field must be studied under a microscope to determine whether they are tracer material or are iron compounds from other sources. Where field personnel are familiar with microscopic work the determination can be made at the well site. Otherwise the concentrate is removed from the paper lining and analyzed in the laboratory.

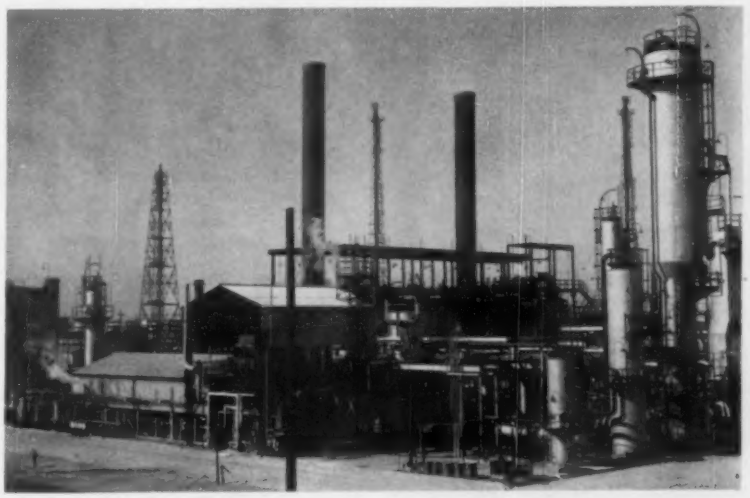
If the material is an additive, the tracer must be identified in order to tell which cement job is leaking. This is accomplished through familiarity with the characteristics of the various types now in use.

Accompanying diagrams illustrate the identifiable characteristics of two types in use. As shown most of the perlite particles in Type A, viewed at a magnification of 100 to 150 times, are angular and are larger than the diatomes of Type B. The latter, generally studied at a magnification of 200 to 250 times, are considerably smaller and are more cylindrical in shape. The larger spherical particles shown in the two diagrams are the magnetic solids added for the purpose of concentrating the tracer.

Extent of use . . . Most work with cement tracer additives has been in California fields. There, Macco Corp., sole licensee for the process, has arranged with laboratories in Long Beach, Ventura, and Bakersfield to do the microscopic work.

The company currently is making additives available to operators and cement companies throughout the Southwest, Mid-Continent, and Rocky Mountain areas. Arrangements likewise are being made for microscopic examination in various laboratories.

Distribution of the tracer materials has been arranged for in South American and European fields also. At least one major company is planning to use them in all wells it completes in Venezuela and Europe. Field personnel in those areas will be trained in microscopic work, and examination carried out at the well site. **End.**



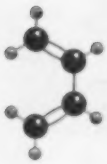
Indiana Standard Continues Program

A SECOND new large-volume Ultraformer at the Whiting refinery, Standard Oil Co. (Ind.), is operating successfully on its first run. Capacity is 21,000 bbl. per day. And steel work is being raised for a third Whiting Ultraformer, similar to the unit just started up. Whiting Ultraformer No. 1, with a capacity of 14,000 bbl. per day, was put in operation a year ago.

When the third unit comes on stream, the 220,000-bbl. refinery will have a catalytic reforming capacity of 56,000 bbl. daily.

The new Ultraformer is one of several large-scale facilities put into operation recently at the Whiting refinery. Among them are:

1. A new 60,000-bbl.-daily pipe still, increasing crude capacity to about 220,000 bbl. a day and permitting shutdown of several small crude running units.
2. A modern 6,000-bbl.-daily lubricating-oil plant.
3. A modernized alkylation unit, and a large-volume high-octane gasoline-manufacturing plant.



MAKING BUTADIENE—1

What's Happened to Butadiene

. . . since private industry took over?

This is the first of a five-part series which will bring the reader up-to-date on progress in this field since the Government got out of the butadiene business. Succeeding installments will cover butylene and butane dehydrogenation, feed preparation, and finishing methods.

By John C. Reidel
Petrochemical Editor

BUTADIENE, "this highly reactive diolefin" and large-volume ingredient of GR-S rubber, was under the government lid until 1955. Then the Government sold the plants—and the lid came off with a bang! In a few years under private ownership U. S. butadiene capacity will have almost doubled to over 1,000,000 short tons annually—figuratively an "explosive" expansion!

● **The current expansion** in butadiene has come to a close. For the time being there is plenty of butadiene. The competition is not yet "rough" but it does promise to be "keen." While bringing new or expanded facilities on stream, operators have been keeping an eye on the future. There is talk of another round of activity coming perhaps by 1960-61.

● **New large-scale uses** for butadiene could result from currently intensified research programs. But the saying "as goes GR-S so goes butadiene" is expected to hold through the next 3 to 5 years. (By "large scale" uses with reference to butadiene we mean at least 50,000,000 lb. per year or perhaps more in the order of 100,000,000 lb. per year which is the capacity of one of the relatively smaller butadiene plants.) The present end-use patterns for butadiene is roughly 87 per cent for GR-S, 3 per cent for nitrile, and 10 per cent for nylon resins, paint, and miscellaneous uses. Market men do not expect these proportions to alter greatly through 1959. "There will be growth in all three categories," they say, "perhaps a little more in the nylon resins, paint, and other uses."

● **The trend to field butanes** as feed stock was emphasized by the present expansion. With suitable refinery butylene sources already tied up, new companies on the butadiene scene logically turned to field butanes. This resulted in four new installations in the United States employing improved versions of the Houdry one-step dehydrogenation of n-butane. Another Houdry installation has gone in abroad (Chemische Werke Huels, A.G., in West Germany).

● **Where refinery butylene supplies** have been augmented, these were already spoken for. For example, the B-B stream coming from new cat cracker facilities being built by Humble Oil & Refining Co. at Baytown goes to Humble's own expanded butadiene and butyl rubber operations.

● **The demands on C_4 hydrocarbons** will be heavy. Increased requirements as raw material for chemical manufacture, and steadily rising octane and increasing front end volatility in gasoline, will contribute to this. However, the enlarged demand will be met by intensifying recovery of C_4's from refinery streams, extending transmission and storage facilities, and by increasing production of butane.

● **Around the corner** may be high-yield fluid-bed and moving-bed processes for dehydrogenation of butane to butylenes. Such techniques, however, are not likely for dehydrogenation of butane or butylenes to butadiene. Meanwhile, there has been development of new or improved catalysts on existing fixed-bed processes for both butylene and butane dehydrogenation.

From Orange to Odessa

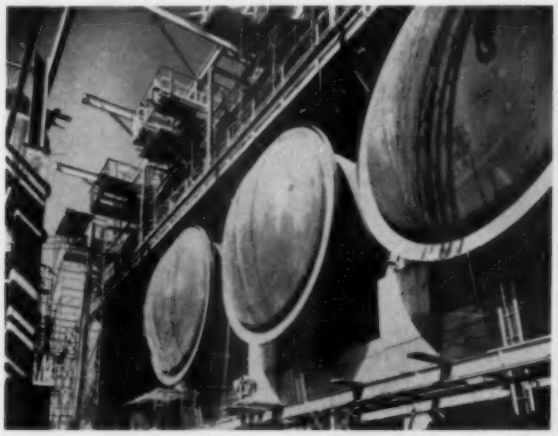
A quick look at Table 1 tells what happened to U. S. butadiene capacity after the Government sold the plants. As of May 1, 1955, total petroleum-derived capacity was 620,500 short tons per year. With the completion of the Odessa Butadiene Co. plant in the last quarter of 1957, annual U. S. capacity will total 1,069,400 short tons. When the announced Neches Butane Products Co. expansion program is completed, perhaps in the fall of 1958, the annual capacity will total 1,149,400 short tons.

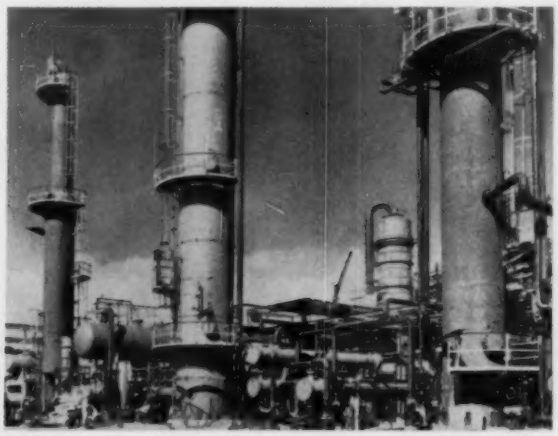
Processing . . . For those not familiar with butadiene processing, it should be noted that the major portion of butadiene production in the past has been by dehydrogenation of butenes, employing the **steam dilution** process originally developed by Standard Oil Development Co. (now Esso Research & Engineering). The butenes come mainly from refinery cat cracker B-B streams.

However, butane can be used as the primary feed stock. This can be dehydrogenated by the **Houdry one-step** method with recycle of the butenes that are also formed back through the Houdry reactors, the operation being aimed at an optimum ultimate yield of butadiene. The Houdry dehydrogenation is an essentially adiabatic operation, carried out over a fixed bed without steam.

On the other hand, the Houdry dehydrogenation of butane may be aimed primarily at producing a butene-rich stream with relatively minor amounts of butadiene formed per pass. The butenes so produced can then be fed to existing steam-dilution process dehydrogenation facilities to make butadiene. An example of such a tiein is provided by the so-called "tandem" operation conducted between Standard Oil Co. of California at El Segundo, Calif., and Shell Chemical Co. at Torrance, Calif. Standard uses Houdry facilities to make a butene-rich stream with some butadiene. The crude mixture goes to Shell Chemical. Here the

The site—a prairie in Orange County, Texas. Dehydrogenation towers begin to rise . . .





. . . and here they are ready for action. This is the gas-recovery section.

butenes are concentrated and fed to steam - dilution - process facilities for dehydrogenation using Shell 205 catalyst. Shell extracts the butadiene and returns a portion of the finished butadiene to Standard.

Petro-Tex Chemical Corp. at Houston also has a tiein between its original (Esso-type) steam dilution facilities and its new Houdry installation.

Butane can also be dehydrogenated by the **Phillips two-stage** process as has been done by Phillips Chemical Co. at Borger since 1943. The Phillips process is different in that the first stage—dehydrogenation of butane to butenes—is conducted in multitubular reactors as an essentially isothermal operation. The Phillips second stage — dehydrogenation of butenes to butadiene—employs steam dilution over a catalyst bed (adiabatic).

Table 1 also indicates the feed-preparation and butadiene - finishing methods employed at each of the plants:

1. Two of the plants with steam-dilution dehydrogenation facilities employ acetone extractive distillation (a Shell development) for concentration of butenes fed to those facilities. For extraction of butadiene from the reactor effluent, these plants employ the C.A.A. (cuprous ammonium acetate) method—an Esso Research development.

2. However, Shell at Torrance recently switched to acetonitrile extractive distillation (a Shell-patented process) in its feed-preparation section.

3. Other plants with Esso - type (steam dilution) dehydrogenation facilities (Neches Butane Products Co. and Petro-Tex) use the Phillips-developed furfural extractive distillation in both the feed-prep and butadiene-separation sections. Phillips also uses furfural following each stage of dehydrogenation at Borger.

4. Plants based on the Houdry one-step dehydrogenation with butane feed employs either C.A.A. or furfural for butadiene separation, although they could use any other of the separation processes suitable for this purpose.

Butane feed . . . The shift to field butanes as feed stock is underscored by the figures in Table 1. At the time of plant sale only two operations employed butane feed. These totaled 138,000 tons per year of butadiene capacity.

Actually, most of the butane was first processed to butylene and then converted to butadiene by the steam dilution method. We are referring here to the two-stage facilities of Phillips at Borger (formerly 74,000 tons per year) and the "tandem" Shell-Standard of California operation. Combined capacity of the latter was 64,000 tons per year. Only 14,000 tons per year of butadiene was made directly from butane in the Houdry facilities at El Segundo. In addition, the plant at Houston (formerly operated by Sinclair and now owned by Petro-Tex) also made a small amount of butadiene based on butane. This was barged to Houston in the form of butylenes coming from the U.O.P.-type dehydrogenation unit at Corpus Christi; the major feed at Houston was refinery butylenes.

On completion of the present round of expansion (i.e., when Neches Butane comes up to its announced 300,000-ton capacity in 1958) the capacity based on refinery butenes as

Methods for making a new antiknock compound are investigated by an Ethyl research chemist.

How Ethyl Chemical Research Advances Antiknock Technology

Break-throughs in Organo-Metallic Chemistry Point to More Effective Antiknock Agents and New Tetraethyllead Production Methods

EVER SINCE the discovery of tetraethyllead as the first practical antiknock additive, Ethyl scientists have been searching for even more effective and economical antiknock agents.

Extensive research on both organic and metal-organic materials in our Detroit Research Laboratories has shown that the metals are the most promising. Our research also has shown that these materials promise important new advances in tetraethyllead production methods.

Our efforts to learn more about organo-metallic compounds also have enabled us to make significant contributions to chemical knowledge outside the antiknock field. Ethyl's continuing publication of such information contributes to the expansion of knowledge in this field of chemistry.

Developments in Organo-Metallic Chemistry Offer Antiknock Promise

Much of the early work on metallic antiknocks was hindered by the lack of compounds with solubility, volatility, and stability characteristics suitable for use in gasoline.

Recent break-throughs in chemical knowledge, which were used to good advantage by Ethyl scientists, have indicated that a wide variety of metals might be incorporated in organic compounds. The synthesis of organo-metallic compounds with suitable physical characteristics has enabled us to consider a number of them as antiknock possibilities.

One organic manganese compound, which we call AK-33X, shows definite promise of increasing the power output of piston aircraft engines, when AK-33X is used as a supplement to tetraethyllead. Extensive tests now are being made to determine its effectiveness for automotive use both as a supplement to tetraethyllead and as a primary antiknock.

High-pressure autoclaves in Ethyl's Baton Rogue and Detroit Laboratories are used to run organo-metallic reactions at high pressures and temperatures.

Tetraethyllead Is Synthesized From Common Lead Compounds

Another recent accomplishment of Ethyl's organo-metallic research is a new method of synthesizing tetraethyllead from a wide range of organo-metallic compounds by reacting them with common lead compounds such as lead oxide, lead sulfide, and lead dioxide. This radical departure from present technology circumvents the use of sodium and chlorine.

Major development work remains to be done before this new method can be used commercially. However, our studies of all phases so far have led us to believe that considerable advances in tetraethyllead production methods are within reach.

Chemical Contributions Outside Antiknock Field

An added benefit of the synthesis of tetraethyllead and other organo-metallic compounds is the development in our laboratory of improved techniques for manufacturing triethyl aluminum. This compound is of high interest as a possible new route to the manufacture of tetraethyllead.

Triethyl aluminum also is important as an ingredient in catalysts for olefinic polymers and particularly high density polyethylene, as an alkylation agent for active metals and less active salts, and as a reducing agent comparable to lithium aluminum hydride. Triethyl aluminum and trimethyl aluminum also are being considered for military fuel applications

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The Ethyl scientific team has a solid research background in fuel-engine relationships plus a comprehensive knowledge of organo-metallic chemistry.

In addition, the Research Laboratories are uniquely organized to evaluate the potential engine applications of new fuel or lubricant additives. These are good reasons why we look forward to even more important advancements in the fields of antiknock chemistry and organo-metallic research.

In so far as possible, data on all Ethyl's current research projects in antiknock technology and organo-metallic research will be made available to the Oil Industry.

How Ethyl Research is helping you

In the 36 years since the discovery of tetraethyllead as the first practical antiknock additive, Ethyl's search for new antiknock agents has continued.

New compounds and their value to the Petroleum and Chemical industries are investigated on a continuing basis in our laboratories in Detroit, Mich. and Baton Rouge, La.

Research in the field of organo-metallic chemistry is only one of the many facets of Ethyl's research program.

Ethyl's scientific manpower, experience and facilities are dedicated to the search for fundamental knowledge of the behavior of fuels and engines, guided by the needs of the Petroleum Industry.

ETHYL CORPORATION
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ETHYL ANTIKNOCK COMPOUND ETHYL CORPORATION

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Table 1–U. S. Butadiene, Petroleum Derived[1]

(Plant capacity and expansion, 1955-58, in short tons per year; feed stock and process)

Company and location—	Capacity May 1, 1955	Capacity Dec. 31, 1957	Feed stock, process[2]
Allied Chemical & Dye Corp.: Tonawanda, N. Y.		4,000 (est.)	Ethylene cracking byproduct
Copolymer Rubber & Chemical Co.: Baton Rouge, La.	23,000	30,000	Butylenes.[3] Steam dilution (C.A.A.)
Dow Chemical Co.:[4] Midland, Mich., and Freeport, Tex.		17,400	Ethylene cracking byproduct
Esso Standard Oil Co.: Baton Rouge, La.	37,500	50,000	Ethylene cracking byproduct (C.A.A.)
Firestone Tire & Rubber Co.: Orange, Tex.		[5]40,000	Butane. Houdry one-step (C.A.A.)
Humble Oil & Refining Co.: Baytown, Tex.	49,000	[6]65,000	Butylenes. Steam dilution (Acetone, C.A.A.)
Neches Butane Products Co.: Neches, Tex.	190,000	[7]220,000	Butylenes. Steam dilution (Furfural)
Odessa Butadiene & Chemical Co.: Odessa, Tex.		[8]50,000	Butane. Houdry one-step (C.A.A.)
Petroleum Chemicals, Inc.: Lake Charles, La.	63,000	[9]80,000	Butylenes. Steam dilution (Acetone, C.A.A.)
Petro-Tex Chemical Corp.: Houston	90,000	[10]200,000	Butylenes. Steam dilution Butane. Houdry one-step (Furfural)
Phillips Chemical Co.: Borger, Tex.	74,000	[11]112,000	Butane. Phillips two-stage (Furfural)
Shell Chemical Corp.: Torrance, Calif.		[12]70,000	Butylenes. Steam dilution (Acetonitrile, C.A.A.)
	[12]64,000 (comb. cap.)		
Standard Oil Co. of California: El Segundo, Calif.		[12]16,000	Butane. Houdry one-step (no feed prep. or finishing)
Texas Butadiene & Chemical Co.: Channelview, Tex.		[13]80,000	Butane. Houdry one-step (Furfural)
Union Carbide Chemicals Co.: South Charleston, W. Va., Texas City, Tex., and Seadrift, Tex.	30,000	[14]35,000	Ethylene cracking byproduct
Total	620,500	1,069,400	

1. Butadiene-from-alcohol: Kobuta, Pa., facilities bought by Koppers Co. but not being used for butadiene production; Louisville, Ky., plant (butadiene capacity 84,000 tons) unsold to date—lease held by Publicker Industries, Inc., expires April 4, 1958.

2. "Steam dilution" refers to basic butylene dehydrogenation process employing varying steam to butylenes ratio and giving somewhat different yields, depending on catalyst used.

3. Obtains butylene concentrate as feed stock (does not have own feed-prep unit). C.A.A. for butadiene finishing.

4. In addition to the 17,400 tons per year capacity listed for Dow in the Attorney General's report,[2a] this company is building a new ethylene plant at Bay City, Mich., with butadiene recovery facilities.

5. New plant on stream in 1957.

6. Expansion of 16,000 tons completed in 1957. Isobutylene extraction located in adjacent Humble butyl-rubber plant.

7. Facilities owned equally by Texas-U. S. Chemical and Goodrich-Gulf. Full production from expanded facilities in late 1958 or early 1959. Total capacity will then be 300,000 tons per year. Putting in Dow catalyst for new portion of plant; old portion remaining on Shell catalyst.

8. On stream in October, 1957. Some butenes diverted to alkylate plant.

9. Expansion completed in 1956—included revamp of feed-prep and butadiene-finishing sections. Will use isobutylene for new butyl-rubber plant.

10. Expansion of 100,000 tons completed in first half of 1957. To original butylene dehydrogenation facilities, added two groups of Houdry reactors for butane dehydrogenation.

11. Expansion completed in 1957.

12. Formerly carried as combined capacity of equivalent butadiene (crude butadiene and butylenes). Capacity given here is of finished butadiene. This is 16,000 tons butadiene and 1,867 bbl. per calendar day of butylenes for Standard and 70,000 tons butadiene for Shell. Expansion completed by Shell in 1956 included revamp of feed prep, changing from acetone to acetonitrile extractive distillation, boosting feed-prep capacity from 2,100 to 3,000 bbl. per day.

13. Plant on stream in first half 1957. Installation includes two groups of Houdry reactors to run in conjunction with 8,300-bbl. per day alkylation plant. Nominal design capacity: 65,000 tons butadiene and 2.5 million barrels aviation-grade alkylate per year, or 80,000 tons butadiene when operating for this product alone.

14. Does not include possible additional butadiene capacity from new ethylene plant to be built in West Virginia.

feed will total 565,000 tons and that based on butane will total 478,000 tons with ethylene cracking byproduct accounting for 106,400 tons. These figures are arrived at by considering the total (86,000 tons) for Shell and Standard of California as being based on butane. Also, for Petro-Tex 90,000 tons is based on butenes and 110,000 tons on butane.

Percentagewise, the shift in feed stocks sums up as follows:

(Petroleum-derived butadiene)

	Per cent of total capacity	
	May 1, 1955	1958
Ethylene cracking by-product	10.9	9.2
Butane	22.2	41.6
Butylenes	66.9	49.2

Actually the percentage for ethylene cracking byproduct will be slightly higher than indicated in 1958 since an additional though relatively minor quantity of butadiene will be added from this source when the Dow ethylene facilities are completed at Bay City, Mich. Also, note that Union Carbide Chemical Co. will build a new ethylene plant in West Virginia and may recover byproduct butadiene.

Houdry one-step . . . Houdry Process Corp. initially spent upward of $800,000 developing its one-step butane dehydrogenation method and has probably spent much more improving the process. But it was a latecomer in the World War II race to make butadiene. Only two Houdry-process plants were built during the war. The one operated by Sun Oil Co. at Toledo was shut down at the end of the war. The Standard of California facilities at El Segundo are still running in conjunction with the Shell plant at Torrance, as explained above.

The payoff . . . Then came the payoff. After the plants were sold, some interesting mergers were formed. The new companies so created turned to the Houdry process.

From Orange to Odessa Houdry reactors have been swinging into place. On the open prairie near Orange, Firestone Tire & Rubber Co. brought on stream a 40,000-ton butadiene plant. Firestone envisions this as possibly the first step in a new petrochemical center.

Texas Butadiene & Chemical Co. (principal stockholders are Godfrey L. Cabot, Inc., and Carl M. Loeb Rhoades Co.), built the Lyondell plant on the San Jacinto River at Channelview near Houston.

Petro-Tex Chemical Corp. bought the Houston butadiene plant formerly operated by Sinclair Rubber, Inc., and immediately got into an aggressive program planned several years into the future. Petro-Tex was formed as a joint corporation between Tennessee Gas Transmission Co. and Food Machinery & Chemical Corp.

At Odessa, Tex., field butanes and Houdry one-step dehydrogenation team up again. Here it is Odessa Butadiene Co. formed by El Paso Natural Gas Co., United Carbon Co., and Odessa Natural Gasoline Co. Again a new petrochemical center seems to be shaping up, the first in this part of West Texas. General Tire & Rubber Co. has an adjacent GR-S copoly plant. El Paso is building an alkylation unit which will presumably use a portion of the butenes formed by Houdry dehydrogenation.

Interconversions . . . Expansions of existing plants utilizing butylenes as feed stock also involve some other interconversions. The example that comes to mind is Petroleum Chemicals, Inc., at Lake Charles, La., which completed a 17,000-ton butadiene expansion in 1956. Byproduct hydrogen from the butylenes dehydrogenation will go to an ammonia plant now under construction. Isobutylene from the cold acid polymerization unit, in the feed-prep section of the butadiene plant, will go to butyl-rubber manufacture.

Wartime Plant

Methods for making alcohol-derived butadiene were developed before those which are based on petroleum. However, the petroleum companies were busy too. Phillips, for example, was already a supplier of butadiene to Hycar Chemical Co., the synthetic-rubber subsidiary formed in 1940 jointly with B. F. Goodrich Co. In the wartime synthetic-rubber program some 400,000 short tons per year of rated capacity was based on petroleum and 220,000 tons was alcohol-derived.[2]

Alcohol butadiene . . . At the end of World War II the alcohol route had some strong political backing. But the economics were all on the side of petroleum-derived butadiene. Despite the political agitation the alcohol route fell by the wayside. An attempt was made recently to revive the issue by way of the Douglas bill brought up for consideration by the legislative Committee on Banking and Currency. The bill proposed an experimental government program to determine the cost of making butadiene from alcohol. But alcohol butadiene costs have been carefully determined by companies experienced in butadiene manufacture. The butadiene industry is now entering a period of intense competition. With better dehydrogenation catalysts and improved methods for making butadiene from petroleum butenes or field butane it is doubtful that alcohol butadiene can catch up with the parade.

Petroleum butadiene . . . Wartime butadiene facilities included five installations employing high-temperature steam-naphtha cracking. Four of these installations were at refineries and consisted of thermal cracking equipment modified for this service. The fifth facility, operated by Southern California Gas Co. at Los Angeles, cracked naphtha in regenerative gas furnaces. This latter was a modification of the process used to crack liquid hydrocarbons to supplement manufactured gas. The naphtha-cracking installations accounted for 14 per cent of the total wartime petroleum-derived butadiene.

Another 14 per cent of total wartime petroleum butadiene was made by dehydrogenation of n-butane, with two installations employing the Houdry one-step method and one installation using the Phillips two-stage process.

The remainder of the petroleum butadiene came from catalytic dehydrogenation of refinery butylenes through the process originally developed by Standard Oil Development Co. Standard Development had already worked out the steam dilution process and was doing the engineering for a commercial plant when Pearl Harbor came.

One of the first sources of butadiene required for the early pilot plants of the rubber companies was supplied by Dow Chemical Co. at Midland. This was obtained as a byproduct of severe cracking of gas oil to make ethylene. The butadiene was separated from a C_4 stream by azeotropic distillation with ammonia. Production of butadiene by this means at Midland ultimately attained a rate of between 1,500 and 2,000 short tons per year during the war.

Also mention might be made of Shell's early contribution using the dehydrochlorination process for the production of butadiene. This was the first commercial butadiene plant to operate in the early forties.

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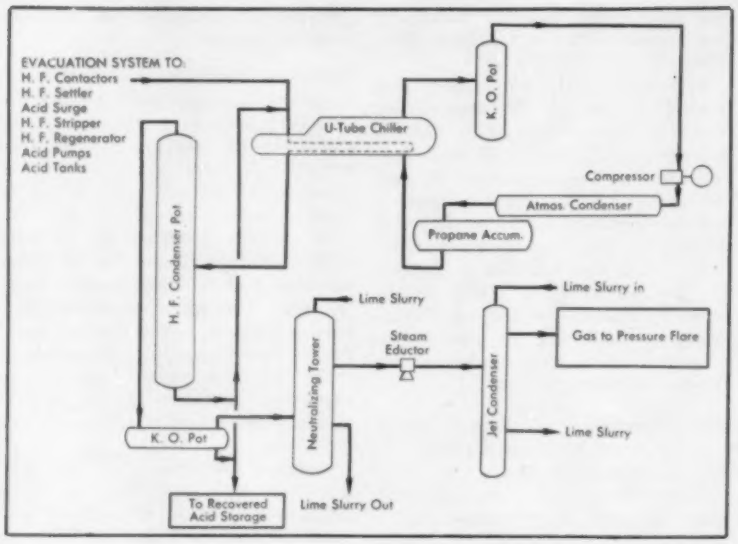

Propane chiller cuts acid losses at California HF akly unit

By D. H. Stormont
District Editor

A REFRIGERATION unit added to the acid-recovery system of an HF alkylation plant in General Petroleum Corp.'s Torrance, Calif., refinery is proving quite worth while. Initial operations indicate lower losses of acid will result in a payout in about 2½ years.

When any part of the hydrofluoric acid circuit is shut down, the vessels, lines, and pumps are first drained to recovery tanks. Remaining material is then removed via an evacuating system (which also collects vapors from the liquid-recovery tanks) to a propane chiller. There the acid vapors, and some light hydrocarbons, are condensed and sent to the recovery tanks for eventual return to the acid system.

Formerly the acid vapors were neutralized by contact with a hydrated lime slurry in a neutralizing tower.

Evacuating system . . . As indicated on the accompanying flow chart, the evacuating system is tied into the acid contactors, settler, acid surge tank, stripper, regenerator, acid pumps, and tanks where fresh and recovered acid are stored.

Vapors evacuated when any or all of this equipment is shut down first pass through the tube side of a propane chiller. Condensable material drops out as a liquid in the HF condensate pot.

Noncondensables leave the pot as a vapor, and after passing through a knockout pot are run to the neutralizing tower. There they are washed with lime slurry before entering the stream eductor which makes it possible to pull a vacuum on the evacuating system. The eductor discharges into a condensing pot, where the vapors contact circulated lime slurry. Any noncondensables are burned in a smokeless flare.

Liquids are continuously pumped from the condensate pot by a centrifugal pump. They are either discharged to the recovery tanks or are recirculated through the chiller as discussed later.

Control for the rate of evacuation is provided by a regulator on the uncondensable vapor line from the condensate pot. This regulator adjusts as necessary to hold a pressure of 5 psia. downstream from it. If this pressure is exceeded, the valve will close sufficiently to slow down the rate of evacuation and decrease the pressure.

An overriding control on this regulator acts to maintain a temperature of minus 5° F. at the outlet of the chiller. If the temperature of the material going to the pot exceeds minus 5° F. the regulator will close slightly and slow down the flow.

As mentioned earlier, the condensate pump operates continuously, discharging to the recovery tanks and the chiller. The latter is a small, naturally controlled stream recycled continuously through the chiller. This is necessary to hold a low temperature in the pot during the prolonged intervals when no equipment is being evacuated.

The major flow from the pump to the recovery tank is controlled by a motor valve in the discharge line. A float in the HF condensate pot actuates the valve, opening it during an evacuation to allow condensate to be pumped to the recovery tanks.

When the level in the pot again drops to the control point, the float closes the motor valve. This leaves the recycle stream to the chiller as the sole pump discharge. To protect the pump, size of this stream is regulated to give a maximum temperature rise across the pump of 20° F.—from about —5° to +15° F.

Refrigeration side . . . Boiling of propane on the shell side of the chiller provides the cooling of the acid vapors. Control of the flow of propane to the chiller is maintained by a float control in the chiller. As the level drops from propane being vaporized, the float control operates to allow more propane to enter.

The chiller is served by a 100-hp. compressor. It speeds up or slows down in accordance with the pressure on the shell side of the chiller.

If this propane increases above 33 psia., the pressure controller will open a regulating valve in the steam supply line, causing the compressor to speed up. If the pressure drops below 33 psia., the steam valve closes.

An overriding control is set up so that if the pressure drops below 31 psia., a bypass valve is opened on the propane compressor discharge. This results in hot propane being bypassed to the chiller to maintain the pressure above 31 psia.

One other regulator is provided on the steam line to the compressor, controlled by the high-level alarm on the knockout pot upstream from the compressor. If the liquid level builds up to this point the level alarm will automatically close off this regulator and shut down the compressor. This prevents damage to the compressor.

A lot of mighty good drillers believe that making hole without a BAKER Drill Pipe Float is like driving a car without brakes—you can't forget that something very important is missing.

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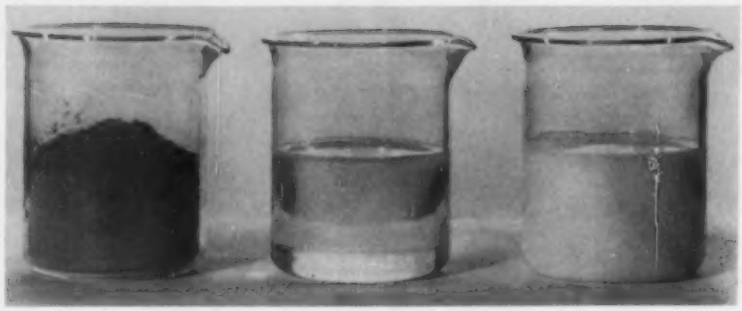


Portland cement + surface-active agent + synthetic liquid latex

+ special mixing equipment =

AN ANALYSIS of 866 jobs with the new latex-cement material used in Cealment* shows very high performance indeed—an over-all success ratio of 75.8 per cent. The data show the latex-cement has been an important addition in specialized oil-well cementing as well as primary cementing itse.f.

This technique uses a slurry containing a special latex material, a surface-active agent, and either regular portland cement or a slow-setting cement. The latex used is a water-thin, milky-white liquid with a density of 10 lb. per gallon. The slurry has many of the desirable properties of both portland cement and oil-field plastics.

Cealment was developed by Dowell in 1955 to provide operators with a dependable cementing service designed especially for oil-field use. The good success ratio, as shown by this survey, is remarkable considering that most of these jobs were done in areas where regular portland cement had given poor results or had failed completely.

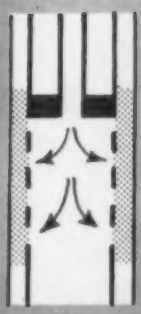
Hundreds of different latexes were laboratory tested to find the one best suited to the cementing of oil and gas wells. And, hundreds of tests were made to develop the chemical agents needed to make the latex-cement set properly under well conditions.

An investigation was made of all jobs done in seven areas from July 1, 1956, to July 1, 1957. These seven areas did 957 jobs, or 86 per cent of all such jobs done in the United States

*A service mark of Dowell Incorporated.

75 Per Cent Success Ratio

1. SQUEEZES — 66.1% Ok



SINGLE-STAGE TO:

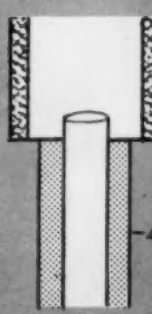
- Shut off water or gas
- Abandon a zone
- Repair casing hole
- Repair primary cement job
- Other remedial squeeze

2. TAIL-INS — 93.4% Ok

PERFORMED TO:

- Obtain good seal around casing shoe
- Form block between closely spaced zones

3. LINER JOBS — 90.0% Ok



during that period. For this report, a job is defined as a single application of the material. Several of the jobs included in this report were performed on a single well—either several stages on one zone, or single stages on several zones.

Results were available on 866 jobs. This represents 90.5 per cent of the jobs surveyed, or 78 per cent of all jobs done in the United States during that period.

All the jobs have been classified into six types of application. The results of these jobs have been classified as: (1) Successful—where there was no doubt that the material performed as desired; (2) Partial Success—where the material did not achieve the full measure of success desired, yet improved the over-all condition of the well; or (3) Unsuccessful—where the material failed to perform as desired. The success ratio in Table 1 is based only on the jobs classified as successful.

1. Squeeze jobs . . . These were on wells in which the material was displaced, then forced into the desired position with pressure. All jobs reported were single-stage applications to shut off water or gas, abandon a zone, repair a casing hole, repair the primary cement job, or accomplish other remedial cement squeeze work.

Although exact figures were not available, the majority of these squeeze jobs were done on zones in which regular cement squeeze jobs failed. One major oil company reported that where they were using Cealment, the first stage was successful; two, three, or even more stages were required when using regular portland cement. This comparison was based upon squeeze jobs done by Dowell—using the same application technique with both regular portland cement and latex-cement. There is no doubt that in some cases the Dowell squeeze technique used with latex-cement resulted in success where other materials and techniques failed. However, the operators interviewed generally attributed the success to the material.

The 105 failures, 27.0 per cent of the total number of squeeze jobs, were attributed to many causes. Some of the reasons were: equipment failure—3; flash setting—5 (no flash sets were encountered in the other types of application); failure of material to set due to migrating water—14; other conditions beyond the cementer's control—6. It is felt that with increasing experience with latex materials and other cement, plus the development of better mixing and handling equipment, and improved service in general, failures of Cealment squeeze jobs can be held below 25 per cent.

The majority of the squeeze jobs using latex-cement were done in zones which were difficult to squeeze with other materials. If the success ratio of latex-cement could be compared with that of other cementing materials used in these zones, the superiority of latex-cement as a squeeze material would be readily seen. Reduced rig costs and waiting time, plus equipment charges saved, will offset many times the additional cost of materials on the average squeeze job using latex-cement.

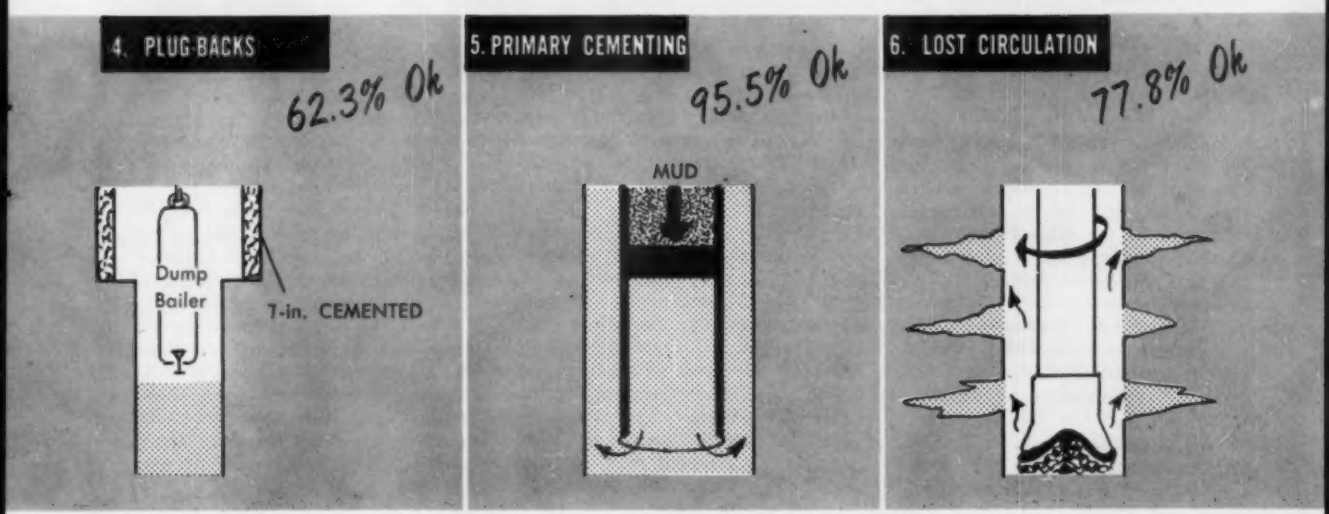
2. Tail-in jobs . . . These are classified as those primary cementing jobs in which latex-cement followed other types of materials and was the last material displaced. Tail-in jobs are done for two reasons: (1) to insure a good cement job around the casing shoe (there is no way to evaluate the success of this type of application unless a shoe failure occurs); and (2) to prevent communication between closely spaced zones as a result of perforating, fracturing or acidizing. About 95 per cent of these tail-in jobs were done in areas which have serious communication problems.

The success-ratio of 93.4 per cent leaves no doubt as to the effectiveness of latex-cement in preventing communication upon completion of close-

TABLE 1—LATEX-CEMENT PERFORMANCE

Application—	Number of jobs	Successful	Partial success	Unsuccessful	Success ratio, per cent
1. Squeeze	389	257	27	105	66.1
2. Tail-in	273	255	5	13	93.4
3. Liner	30	27	0	3	90.0
4. Plug-back	143	89	10	44	62.3
5. Primary cementing	22	21	0	1	95.5
6. Lost circulation	9	7	0	2	77.8

in Well-Cementing Jobs



ly spaced zones. As an operator in Stonewall County, Texas, reported:

"The Canyon sand in Flowers field has from three to five sections with good oil saturation but low permeability. Wells in this formation must be perforated and fractured to make commercial producers. At first, temporary plugging agents were used to divert fracturing fluid to each zone. Production increases obtained with this method were short-lived, probably due to the lack of enough fracturing fluid being controlled into each zone.

"On the next group of wells we perforated each zone and fractured between straddle packers, but there was communication between zones almost every time. Then we tried tailing-in with Cealment, covering the producing sections with latex-cement. We then perforated the zones and fractured between straddle packers to isolate each zone.

"On the 15 or 20 jobs done to date using this method, we have had no communication trouble. We have segregated as close as 8 ft. using Cealment. We used portland cement on 60 or 70 wells and were never able to segregate perforations closer than 18 ft."

3. Liner jobs . . . In these, latex-cement was used to cement liners. With more applications, the success ratio for liner jobs should be comparable with that for tail-in jobs.

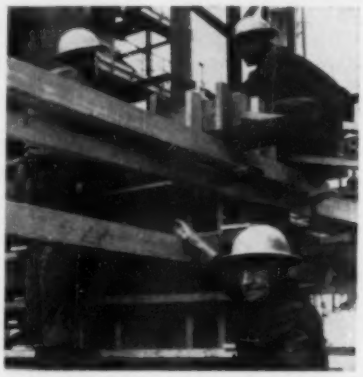
4. Plug-back jobs . . . These were done with dump bailers. Many of the failures were attributed to the use of too little material. In most cases, a second stage on the same well achieved success. Although this application accounted for 17 per cent of all in this survey, the materials used in plug-back work amounted to less than 2 per cent of the total for all jobs. A more accurate estimate of the material required should substantially increase the success ratio of this application.

5. Primary cementing . . . These were jobs in which latex-cement was the only material used to set the casing. The one unsuccessful job was caused by failure of the mixing equipment, which resulted in the casing being cemented with neat portland. These jobs were so small that latex-cement was used to set the entire casing string rather than just for tail-in work. The evaluation of tail-in work will also apply to primary cementing.

6. Lost circulation jobs . . . This application was only 1 per cent of the total number For that reason, and because of the specific problem of this type of work, no comparison was made of the success ratios of this and other methods. Latex-cement has proved its value as a lost-circulation material and must certainly be added to the list of such materials available to operators. **End.**

On the Job

IN THE PLANTS



CARPENTER TRAINEES Tom Keefe, left, and George McGonagle, right, install anchor bolts under the direction of Leo Mulledy. Training with shop machinery and practical experience are a part of the program.

New Training Program Allows Employes to Advance on Merit

A TRAINING PROGRAM that recognizes ability first is proving successful for Esso Standard Oil Co. at its Everett, Mass., refinery.

The program, developed jointly by union and management, replaces the old grade system. Under the new plan, lack of seniority is no barrier to a mechanic's progress.

The new plan was introduced a year ago. Until then, a four-step advancement program was followed. An employe was started as a helper, advanced through third-class and second-class ratings, and eventually became a first-class mechanic. The last step was made when and if an opening occurred.

New program . . . Now a mechanic can attain first-class rating by completing the plant's mechanical-training program. Beginners can do it in 5 years—those who have been working in a craft can do it in less time.

Ten crafts are covered: (1) boilermaker, (2) welder, (3) carpenter, (4) mason-insulator, (5) painter, (6) electrician, (7) instrument man, (8) machinist, (9) pipefitter, and (10) rigger.

Most of the training is the on-the-job type and working-time classroom study. After-hour instruction is available for those who need it in mathematics and blueprint reading. This instruction is given at the plant or in nearby schools.

The men like the training program because:

1. It enables them to advance at a regular pace without the sometimes long and uncertain waiting periods.

2. It means a raise in salary each 6 months for the trainee who advances toward a first-class rating as long as he masters the training for that 6-month period.

The company likes the program because:

1. It enables them to use younger men as first-class mechanics while they are still in their peak-performance years.

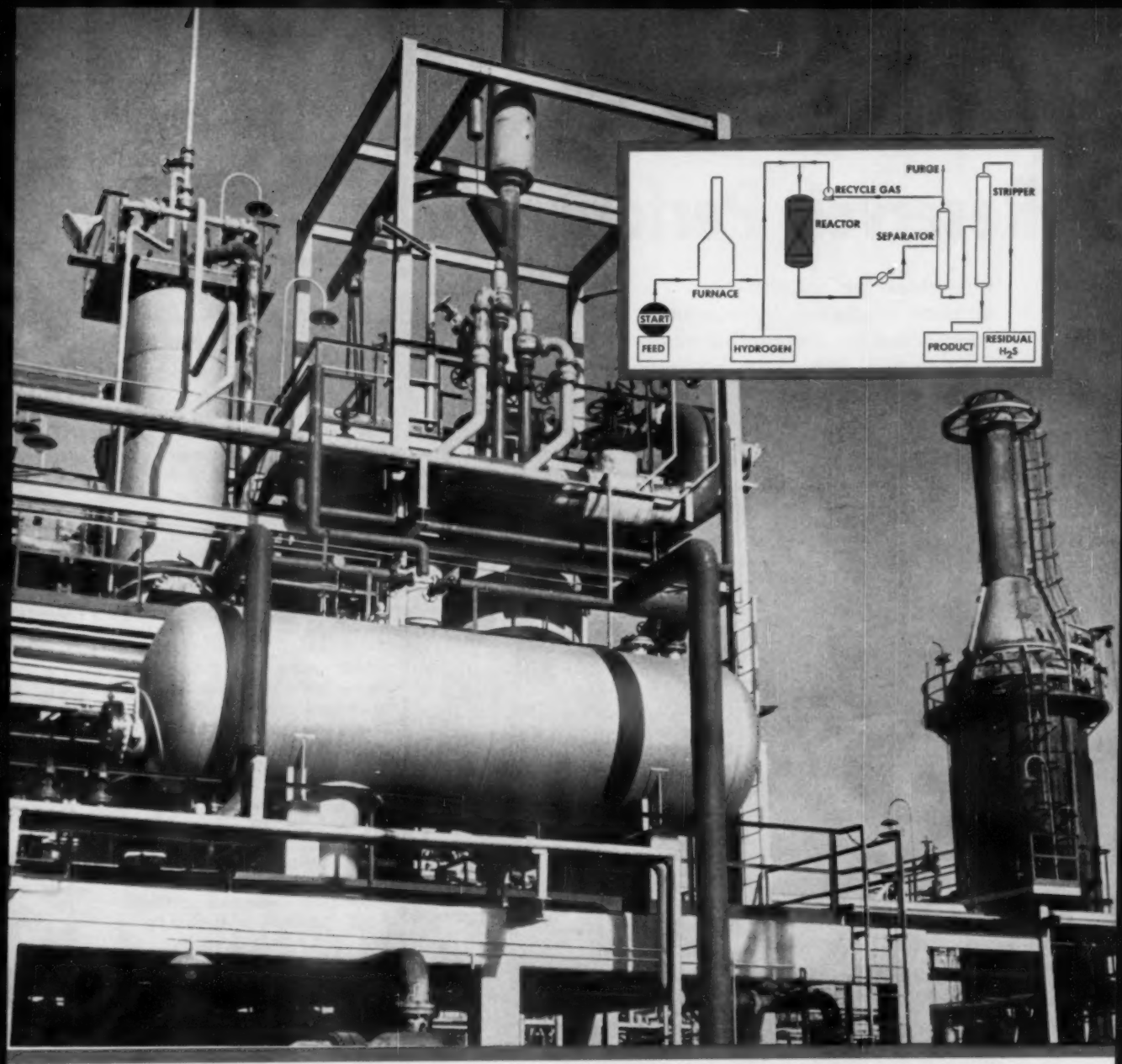
2. The program develops initiative and confidence in the men and they continue to improve.

As a result of the first year of training under the new program, the Everett refinery has 16 new first-class mechanics. Forty-six more men are now taking the training course. The graduates and present trainees represent 68 per cent of the 99 men who were eligible to take the course. The other 65 of the plant's 164-man mechanical staff already held first-class ratings. The mortality rate has been low—only one person who started the course has dropped out.

The program is implemented by a five-man joint mechanical trades advisory committee. Two are members of the Everett Refinery Independent Union and two represent management. F. G. Lewis, Everett's training supervisor, is a nonvoting member.

R. J. Finigan, mechanical supervisor, is responsible for the over-all direction of the plan. The on-the-job training is handled by 10 training supervisors, one for each craft.

After a year's trial, both union and management agree that it works. It still recognizes seniority—first consideration is given to long-term employes—but it does not prevent potentially first-class employes from doing first-class work and earning first-class pay.



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The process improves product stability, odor, color and other quality characteristics without the disadvantages of chemical or clay treating methods. *Hydrofining* is another achievement of the Esso Research program — 38 years of new process developments made available to refiners around the world.

Hydrofining experience has been gained from commercial units processing a wide variety of feed stocks such as naphthas, distillate fuels, lubes and waxes. This experience plus years of hydrogenation research gives us a unique opportunity to recommend the best design for your plant.

Twenty-three *Hydrofining* installations are on stream; eight more are in the construction or planning stage. Licensees enjoy benefits of continuing *Hydrofining* research. *Hydrofining* can play an important part in helping you process previously unattractive stocks into higher quality products. We would welcome your inquiry.

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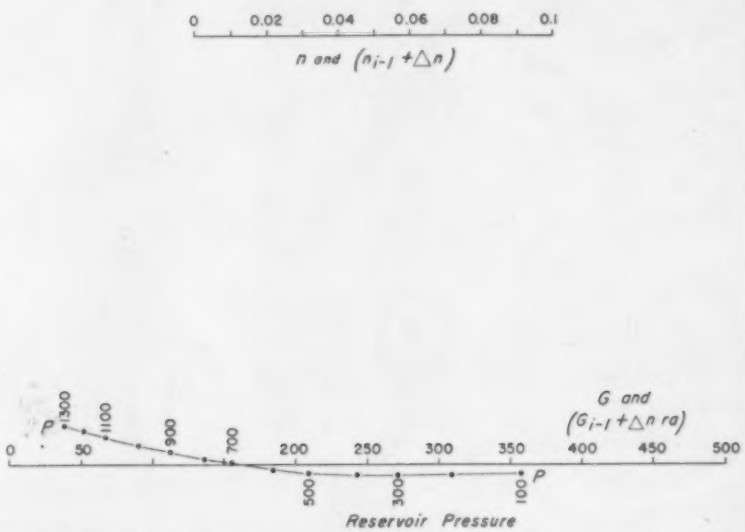
Here's a nomographic method of predicting

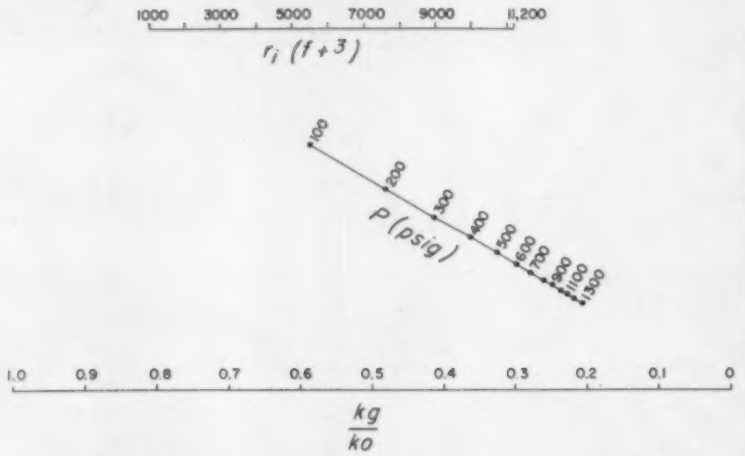
Reservoir Performance

It enables the solution of a trial-and-error material balance prediction by use of a set of nomographs constructed for the specific reservoir operating under solution-gas drive, with no initial gas cap, and no water encroachment.

By Ira Dye



PREDICTION EQUATION and material-balance equation for the specific reservoir described in the text are solved by this nomograph. Fig. 1.



GAS-OIL-RATIO EQUATION may be solved for the specific reservoir described in the text by use of this nomograph. Fig. 2.

RAW DATA necessary for calculation of a material-balance prediction are rarely as accurate as could be desired. Laboratory-obtained P.V.T. data may be accurate without being representative, and estimates of reservoir pressure may be incorrect. There may be some doubt as to the correctness of the extrapolation of relative-permeability curves based on field data, or as to the correlation of laboratory-obtained permeability data with the reservoir being considered.

Thus, in many cases, it may be desirable to make quick estimates of future reservoir performance for a number of sets of permeability-saturation data, or for various assumed values of present reservoir pressure.

The nomographic method presented here allows rapid recalculation of a reservoir prediction, varying the permeability-saturation relationship by marking new k_g/k_o data opposite the appropriate liquid saturation values in Fig. 3. Also, the current, or "historical" reservoir pressure used as a starting point for the calculation can be changed, or assumed to have a different value, and the prediction rapidly rerun.

The construction of the nomographs can be readily done by a draftsman, after the scale moduli are established and the recurrent variable points on Figs. 1 and 2 computed.

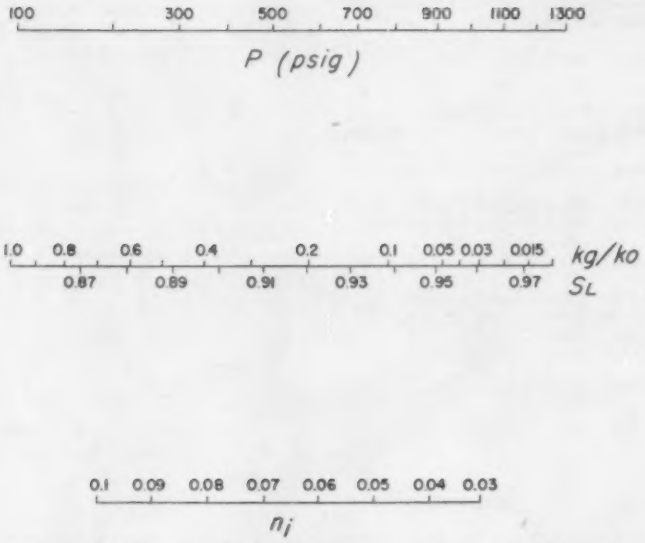
Fluid-characteristics data for constructing the nomographs of a reservoir may be obtained from laboratory P.V.T. analyses or from empirically developed data.

Material-Balance Method

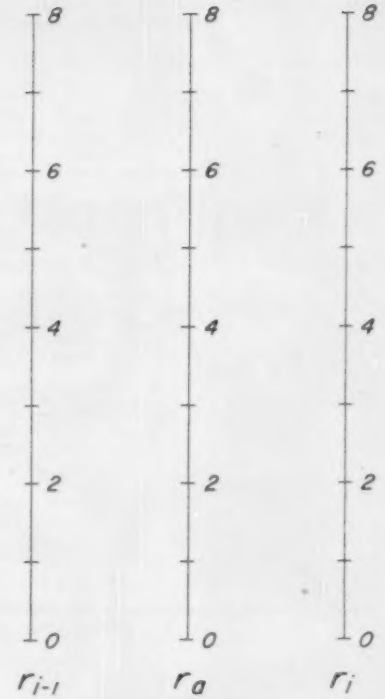
The material-balance method has been widely used for the solution of two general problems: The estimation of original oil in place, and the prediction of future production performance of a reservoir. As normally used, the material balance equation is written volumetrically. It relates the volumes of oil and gas, produced and remaining, by means of the fluid characteristics, at the pressure prevailing in the reservoir.

There have been several changes in technique tending to simplify the calculations required, but the method remains lengthy and tedious, even for the simplest reservoirs.

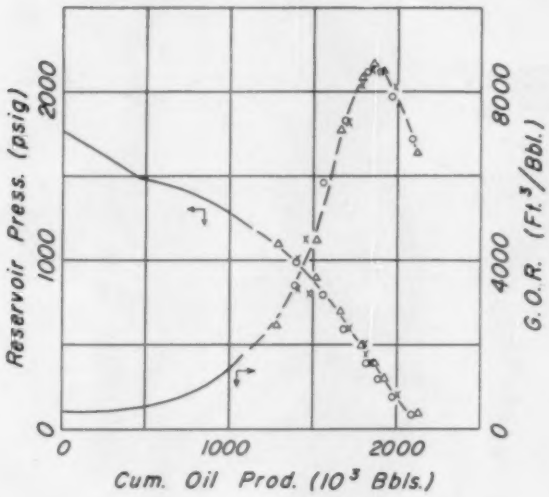
Author is commander, U. S. Navy, U. S. Naval Postgraduate School, Monterey, Calif., currently stationed with Union Oil Co. of California. Paper presented at the 1957 spring meeting at the Pacific Coast District of the A.P.I. Division of Production, Los Angeles. Original title was "A Nomographic Method for Predicting Reservoir Performance."



LIQUID-SATURATION EQUATION may be solved for the specific reservoir described by this nomograph. Fig. 3.

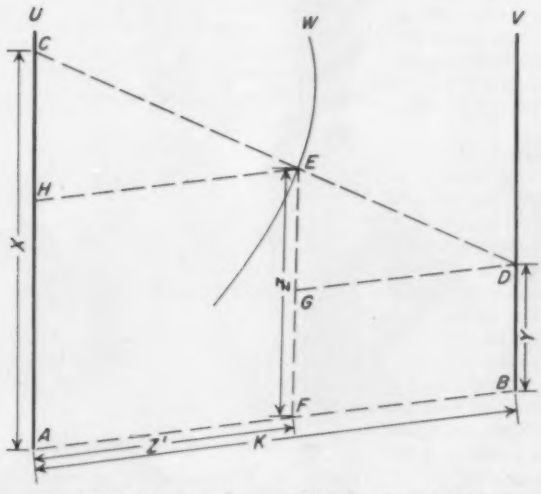


AVERAGE GAS-OIL RATIO may be found by using this nomograph. Fig. 4.

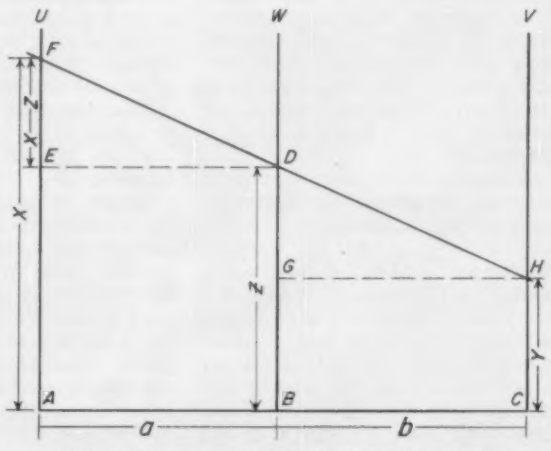


PREDICTED pressure decline and gas-oil ratio as function of cumulative production for the reservoir described. X equals calculated prediction by Tracey's method. O equals prediction by nomographic method first described. Δ equals prediction by alternate nomographic method. Fig. 5.

"The nomographic method presented here allows rapid recalculation of a reservoir prediction, varying the permeability-saturation relationship, by marking new data on one of the nomographs."



GEOMETRY of a recurrent variables nomograph. Fig. 6.



GEOMETRY of a parallel scale nomograph. Fig. 7.

TABLE 1—PREDICTION OF PERFORMANCE OF MID-CONTINENT LIMESTONE RESERVOIR BY NOMOGRAPHIC METHOD

Reservoir press., psig.—		1,209‡	1,000	800	600	400	300	200	100
Steps									
(1)	Δn		0.0135	0.010	0.00745	0.00733	0.00376	0.00462	0.00684
(2)	n_{i-1}		0.032	0.0455	0.0545	0.06195	0.06928	0.07304	0.07766
(3)	n_i	0.0319	0.0455	0.0545	0.0619	0.06928	0.07304	0.07766	0.08450
(4)	$G_{i-1}+r_s\Delta n$	46.75	85.90	131.9	181.1	239.1	270.9	308.7	358.0
(5)	G_{i-1}		46.75	85.9	131.9	181.1	239.1	270.9	308.7
(6)	$r_s\Delta n$		39.15	46.0	49.2	58.0	31.8	37.8	49.3
(7)	r_s		2,900	4,600	6,600	7,910	8,450	8,180	7,210
(8)	r_{i-1}		2,400	3,400	5,800	7,380	8,450	8,450	7,910
(9)	r_i	2,400	3,400	5,800	7,380	8,450	8,450	7,910	6,510
(10)	k_g/k_o		0.057	0.124	0.194	0,305	0.384	0.494	0.692
(11)	r_i (from G.O.R. equation)		3,400	5,820	7,380	8,450	8,450	7,910	6,520
*(12)	$(n_i)(1.8\times10^7)$		819.5	981	1,116	1,249	1,317	1,399	1,521
†(13)	†575,000		575	575	575	575	575	575	575
(14)	Cum. prod. (in 10^3 bbl.)		1,394.5	1,556	1,691	1,824	1,892	1,974	2,096

*1.8×10^7 bbl. is the original oil in place (stock-tank oil). †575,000 bbl. is production prior to bubble point (stock-tank oil). ‡Historical point.

TABLE 2—CALCULATIONS FOR PREDICTION EQUATION (MID-CONTINENT LIMESTONE RESERVOIR)

K = 13 in.
m_1 = 100, (scale = 10 in.)
m_2 = 0.04, (scale = 20 in.)
m_2/m_1 = 0.0004

Scale divisions:
n: 1 in. = 0.01 unit of n
G: 1 in. = 25 units of g

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(P)	ϕ_g/ϕ_o	$1/\phi_o$	$K\phi_g/\phi_o$	$(\phi_g/\phi_o)+m_2/m_1$	m_2/ϕ_o	$z'=\frac{(4)}{(5)}$	$z=\frac{(6)}{(5)}$
1,300	0.004207	0.1396	0.054691	0.004607	0.005584	11.871	1.212
1,200	0.005150	0.2623	0.06695	0.005550	0.010492	12.063	1.890
1,100	0.006502	0.4644	0.084526	0.006902	0.018576	12.247	2.691
1,000	0.008888	0.8064	0.115544	0.009288	0.032256	12.440	3.473
900	0.01306	1.471	0.16978	0.01346	0.05884	12.614	4.372
800	0.02435	3.278	0.31655	0.02475	0.13112	12.790	5.298
700	0.12139	19.135	1.57807	0.12179	0.76540	12.957	6.285
600	—0.04390	—7.918	—0.57070	—0.04350	—0.31672	13.120	7.281
500	—0.01985	—4.078	—0.25805	—0.01945	—0.16312	13.267	8.387
400	—0.01392	—3.262	—0.18096	—0.01352	—0.13048	13.385	9.651
300	—0.0110	—2.911	—0.1430	—0.01060	—0.11644	13.491	10.985
200	—0.009848	—2.971	—0.128024	—0.009448	—0.11884	13.550	12.578
100	—0.01010	—3.538	—0.13120	—0.00970	—0.14152	13.536	14.590

The modified method presented here for predicting the future production performance of a solution-gas-drive reservoir uses simple nomographs to conduct rapid trial-and-error solutions of the material-balance equation. The equation used is a rearrangement of Tracy's equation,[1] which in turn, is based on that of Schilthuis.[2]

A depletion-drive reservoir with no initial gas cap and no water encroachment will be discussed.

Mechanism . . . For any given future pressure in the reservoir, the volumes of oil and gas produced, when related to their properties at that pressure, constitute a unique solution to the equation balancing the original volume of fluid with the volumes produced and remaining. An additional concept is involved, however. The permeability of the porous reservoir medium to oil and to gas changes as production proceeds. Thus, as the saturation of liquid in the reservoir decreases as oil is produced, the relative amounts of oil and gas which flow to the well will change.

This phenomenon cannot be directly related to the material balance itself, yet it determines the relative quantities of oil and gas which will be produced. The relationship between the relative permeability to oil and gas and the liquid saturation in the reservoir must be extrapolated from the field data, or laboratory data used, since it must be considered in arriving at the amounts of oil and gas produced. These amounts of oil and gas can then be used to predict a solution to the material-balance equation at future pressure and production.

Many forms of the material balance equation are available in the literature. One of the most basic and widely used is that of Schilthuis:[2]

$$N = \frac{n\,[u + (r_n - s_o)\,v]}{u - u_o} \qquad (1)$$

Tracy's rearrangement of this equation, published in January 1955,[1] eliminated the two-phase formation-volume factor and cumulative gas-oil ratio, presenting the modified equation in the following form:

$$N = \frac{n\,(B/v - s) + G}{(B/v - s) - (B_o/v - s_o)} \qquad (2)$$

The fluid characteristics, which are functions of pressure, were separated as factors:

$$\phi_n = \frac{(B/v - s)}{(B/v - s) - (B_o/v - s_o)} \qquad (3)$$

$$\phi_g = \frac{1}{(B/v - s) - (B_o/v - s_o)} \qquad (4)$$

Thus, Tracy's form of the material-balance equation became:

$$N = n\,\phi_n + G\,\phi_g \qquad (5)$$

It is common practice to simplify calculations by setting original oil in place, N, as equal to 1 bbl. of stock-tank oil. Equation 5 can then be arranged in two forms:

As the prediction equation:

$$\Delta n = \frac{1 - (n_{i-1}\,\phi_n + G_{i-1}\,\phi_g)}{\phi_n + [(r_i + r_{i-1})/2]\,\phi_g} \qquad (6)$$

As the material-balance equation:

$$n_i\,\phi_n + G_i\,\phi_g = 1 \qquad (7)$$

Prediction of future reservoir performance requires the simultaneous satisfaction of:

The material-balance Equation 7;

the liquid-saturation equation:

$$S_L = S_w + (1 - S_w)\,[(1 - n_i)/B_o]\,B \qquad (8)$$

The instantaneous gas - oil - ratio equation:

$$r_i = (\mu_o/\mu_g)\,(B/v)\,(k_g/k_o) + s \qquad (9)$$

Equations 8 and 9 must be linked by some knowledge or assumption of the relationship between relative permeability and saturation.

Development of the Nomographs

For the trial-and-error solution of Equations 6, 7, 8, and 9, nomographs

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requiring only one line setting were developed. It was felt that the nomographs should be simple enough that the operator could see at a glance how much a given change in one factor would affect the other factors in the problem. Also, with simple, one-setting nomographs, the operator can readily enter the diagram with the dependent variable (or answer) and work backwards to find the value of independent variable (or normal input). This is of value in trial-and-error solutions. For these reasons, as well as for ease of construction, it was desirable that the nomographs be of the type in which a single line crosses all scales, obtaining the answer in a single setting.

By constructing nomographs for a specific reservoir, the fluid characteristics (which are functions of reservoir pressure) and combinations of them, can be treated as recurring functions of a single variable pressure. This reduces the number of variables to the point where simple, single-setting nomographs can be constructed. Construction of the nomographs for a single reservoir allows selection of optimum scale lengths to specially handle the ranges of the variables for that reservoir.

The reservoir for which the nomographs of Figs. 1, 2, and 3 were constructed is a Mid-Continent limestone reservoir which is still not fully developed. It was selected because a thorough engineering study of the pool was available, as were performance predictions calculated by the method of Tracy.

Construction of the Nomographs

The actual dimensions of the nomographs for a given reservoir will depend on the numerical values of data used. The first of the following procedures will apply to construction of the prediction-material balance equation nomograph, Fig. 1, which is a "recurrent variable" type nomograph. Appendix contains further information on the geometry of the nomographs:

1. Take the material-balance equation in the form:

$$n_1 + \frac{G_1}{(B/v - s)} = 1 - \frac{(B_o/v - s_o)}{(B/v - s)} \qquad (10)$$

2. Calculate values for

$$\phi_g/\phi_n = 1/(B/v - s)$$

and

$$1/\phi_n = 1 - \frac{(B_o/v - s_o)}{(B/v - s)}$$

for the range of pressure values over which the prediction is desired.

3. Considering the approximate range of values expected for n and G (based on N equal to 1 bbl. of stock-tank oil), select scale moduli n_1 and n_2 and actual ranges of n and G values so that scale units may be easily plotted.

4. Select any convenient value for K, the distance between zero points on the n and G scales.

5. Compute coordinates of points on the pressure scale from the following relationships, as in the example shown in Table 2:

$$z' = \frac{K\,\phi_g/\phi_n}{(\phi_g/\phi_n) + m_2/m_1} \qquad (11)$$

$$z = \frac{m_2/\phi_n}{(\phi_g/\phi_n) + m_2/m_1} \qquad (12)$$

where z and z′ are the locations of points on the pressure curve, as shown on Figs. 1 and 6. m_1 and m_2 are scale moduli for n and G scales, respectively. K = distance between n and G scales at the zero points.

6. Draw the nomograph. The n and G scales are uniform scales and can be laid off directly with an engineer's scale. The points on the pressure scale may be connected with a smooth curve.

Gas-oil ratio . . . The nomograph for solution of the instantaneous gas-oil ratio equation is constructed in a similar manner.

The form of the equation is:

$$r_i - (k_g/k_o)\,(\mu_o/\mu_g)\,(B/v) = s \qquad (13)$$

The expressions for the coordinates of the points on the pressure scale are:

$$z' = \frac{K\,(\mu_o/\mu_g)\,(B/v)}{(\mu_o/\mu_o)\,(B/v) + (m_2/m_1)} \qquad (14)$$

and

$$z = \frac{m_2\,s}{(\mu_o/\mu_o)\,(B/v) + (m_2/m_1)} \qquad (15)$$

Where:

m_1 and m_2 are scale moduli for the r_i and k_g/k_o scales respectively.

K is the length of the line connecting the zero points of the r_i and k_g/k_o scales.

s, μ, B and v have meanings as listed in the nomenclature.

Liquid saturation . . . The liquid-saturation equation can be solved by means of a parallel-line nomograph with logarithmic scales (Fig. 3). The corresponding values of k_g/k_o from laboratory or field data are penciled on the other side of the liquid-saturation scale for the range being considered. In order to run another prediction on the reservoir using a different k_g/k_o vs. S_L relationship, pencil in the new values for k_g/k_o.

The nomograph is constructed by putting the equation for liquid saturation (8) into the form:

$$S_L - S_w = [(1 - S_w)/B_o]\,(B)\,(1 - n_i) \qquad (16)$$

Assume that the connate-water saturation, S_w, remains constant, and call it K_1. Also, $(1 - S_w)/B_o$ will be constant. Call this value K_2.

Then, the equation is put in form:

$$\text{Log}\,(S_L - K_1) = \text{Log}\,K_2B + \text{Log}\,(1 - n_i) \qquad (17)$$

A standard parallel-scale nomograph can be constructed to solve Equation 17 and the scales graduated in values of S_L, P, and n_i.

An additional nomograph to average gas-oil ratio should also be constructed. This nomograph solves:

$$(r_i + r_{i-1})/2 = r_a$$

It is a parallel-line nomograph with three uniform scales of equal length with equal graduations. The scales are spaced an equal distance apart. Fig. 4 is an example.

In all of the nomographs, construction is simplified if scale moduli are selected which make scale graduations come out in even decimal fractions of an inch, for ease in plotting.

The nomographs should be large in size, with scale lengths about 10 to 20 in.

Use of the Nomographs

Two alternate methods of using the nomographs for estimation of future reservoir performance will be presented:

A. Procedure for first method:

1. Set up a tabulation form as in Table 1. Also, set up a plot of pressure and gas-oil ratio versus cumulative production. Extrapolation of this plot will aid in estimating the increment of oil production, Δn, at each step.

2. Select a point of actual production history, knowing:

(a) pressure, (b) oil production from

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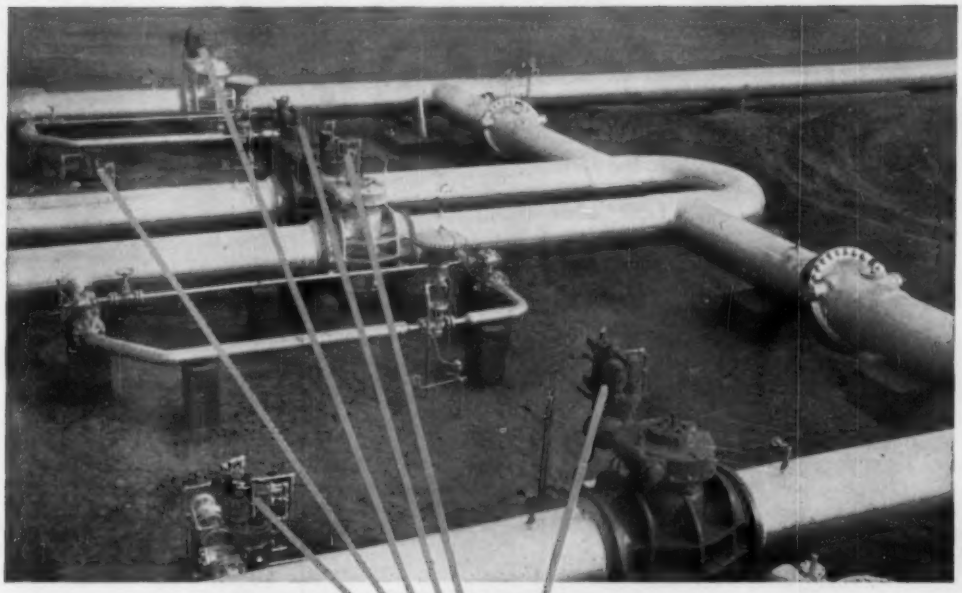

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Nomenclature

B = Formation volume factor, or the volume occupied at reservoir conditions by 1 bbl. of stock-tank oil plus its dissolved gas.
B_o = Value of B at bubble point.
u = Volume in the reservoir occupied by 1 bbl. of stock-tank oil plus all the gas originally in solution in that oil, or the two-phase formation volume factor.
u_o = Value of u at bubble point, $u_o = B_o$.
r_a = Average gas-oil ratio, standard cubic feet per barrel of stock-tank oil.
r_i = Instantaneous gas-oil ratio at reservoir pressure being considered, standard cubic feet per barrel of stock-tank oil.
r_{i-1} = Instantaneous gas-oil ratio at last previously considered reservoir pressure, standard cubic feet per barrel of stock-tank oil.
r_n = Cumulative gas-oil ratio, or the ratio of total standard cubic feet of gas produced to total barrels of stock-tank oil produced.
N = Total original oil in place, in stock-tank barrels.
n = Cumulative oil production, expressed either in stock-tank barrels or as a fraction, when N is taken as equal to 1 bbl.
v = Barrels of free gas space occupied in the reservoir by 1 standard cubic foot of gas.
μ_o = Viscosity of reservoir oil at reservoir conditions, centipoises.
μ_g = Viscosity of produced gas, at reservoir pressure and temperature centipoises.
k_g/k_o = Relative permeability of gas to oil.
s = Solution gas-oil ratio, or the solubility of gas in crude oil at reservoir pressure and temperature, cubic feet per barrel.
s_o = Value of s at bubble point.
S_w = Saturation of connate water in the reservoir.
S_L = Total liquid saturation in the reservoir.
S_o = Oil saturation in the reservoir.
G = Cumulative gas production, standard cubic feet.
Δn = Increment of oil production between two reservoir pressure steps.
$F = (\mu_o/\mu_g)\ (B/v)$.
Subscript i refers to conditions at the pressure being considered.
Subscript i−1 refers to conditions at the immediately previous pressure step in the calculation.

the bubble point to that pressure, n_i, expressed as a fraction of original oil in place, (c) gas production from the bubble point to that pressure expressed in terms of original oil in place, and (d) instantaneous gas-oil ratio, r_i, expressed as standard cubic feet per barrel of stock-tank oil.

3. Assume a new pressure, 100-200 psi. lower than the historical point used. The n_i, G_i and r_i of the historical pressure point now become n_{i-1}, G_{i-1}, and r_{i-1}, in the above tabulation.

4. Estimate an increment of oil production, Δn. Enter this on line 1 of the tabulation. Add to it the n_{i-1}. The sum is n_i.

5. Using this value of n_i at the assumed pressure, enter the prediction nomograph on the n and P scales and read the value of $G_{i-1} + \Delta n\ r_a$ on the G scale. Enter this value on line 4 of the tabular sheet and subtract the G_{i-1} from it. The difference is $\Delta n\ r_a$.

6. With a slide rule, divide the value of $\Delta n\ r_a$, (line 6) by Δn (line 1) to get r_a (line 7).

7. Enter the average gas-oil ratio nomograph (Fig. 4) with r_{i-1} and r_a and find r_i (line 9), or calculate from $r_i = 2r_a - r_{i-1}$.

8. Using n_i (line 3) and pressure, find k_g/k_o from the liquid saturation nomograph and enter this value on line 10.

9. Enter the gas-oil ratio nomograph with k_g/k_o and pressure and find the r_i value based on the gas-oil ratio equation. Place on line 11.

10. Compare lines 9 and 11 which will be equal if the assumed value of Δn was correct.

Note that as assumed values of Δn are increased, resulting values of r_i on line 9 (from prediction nomograph) decrease sharply, whereas values of r_i on line 11 (from gas-oil ratio nomograph) increase slowly. Thus, if the r_i of line 11 is less than that of line 9, a slight increase of Δn will bring them together. If the two values of r_i are within a few hundred of each other, set the $\Delta n\ r_a$ value from line 6 on the slide rule "D" scale, place the value of r_a (line 7) opposite it on the "C" scale, and read a nearly correct value for Δn under the index on the "D" scale.

If this new value of Δn causes a radical change in n_i, it may be necessary to enter the prediction nomograph for a new $G_{i-1} + \Delta n\ r_a$. However, from the scale positions, it can be seen that $G_{i-1} + \Delta n\ r_a$ is very insentitive to changes in Δn at most pressures.

11. If the new value of Δn caused more than a slight change in n_i, reenter the liquid saturation and gas-oil ratio nomograms to obtain a corrected r_i for line 11.

12. Lines 9 and 11 should now be within perhaps 50 or 60 of each other. Alter Δn slightly to bring line 9 in exact agreement with line 11. Add the corrected Δn to n_{i-1}. The result is n_i.

13. Multiply n_i by the volume of original oil in place for line 12 and add line 13, the production from the original pressure to the bubble point. Line 14 is the predicted cumulative production at the assumed pressure.

14. Assume a new pressure about 200 psi. lower and repeat the process. Special care in the averaging of r_i and r_{i-1} must be taken when computing at about the peak of the gas-oil-ratio vs. production curve, as the averaging process assumes local linearity of the curve. It is best to use smaller pressure increments in this region.

B. Procedure for alternate method:

1. Use the same tabulation sheet. In addition, a large "scratch graph sheet" of squared paper (10 by 10 to the inch was used) and a sheet of scratch paper are necessary.

2. Same as step 2 above.

3. Same as step 3 above.

4. Estimate three values of Δn quite close together. Jot on scratch sheet or carry mentally.

5. Enter the prediction nomogram with the middle value of Δn and read a value of $G_{i-1} + \Delta n\ r_a$. (It will be seen that the change in $G_{i-1} + \Delta n\ r_a$ over the three values of Δn is so small as to be unreadable.)

6. Subtract G_{i-1} from $G_{i-1} + \Delta n\ r_a$. Divide $\Delta n\ r_a$ by each of the three values of Δn from step 4 obtaining three values of r_a.

7. On the scratch graph sheet, plot the three values of r_a vs. the respective Δn values.

8. Add the three values of Δn to

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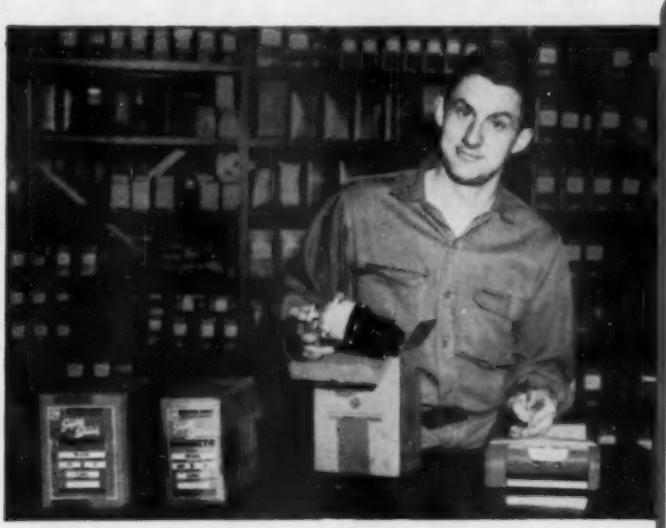

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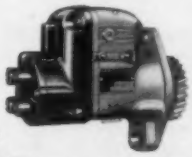

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n_{i-1}. Use the resulting three values of n_i in the liquid saturation and gas-oil ratio nomographs to obtain three values of r_i.

9. Using the average gas-oil-ratio nomograph and entering with r_{i-1} and the three r_i values of step 8, find three values of r_a.

10. Plot these values against Δn values on the scratch graph sheet.

11. Where the lines of step 7 and 10 cross, read the correct values of Δn and r_a. Enter these values on the tabular sheet and check the computation on the nomographs, comparing tabulation lines 9 and 11.

12. Make minor adjustments of Δn to match line 9 to line 11.

13. Same as step 13 above.

14. Same as step 14 above.

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APPENDIX

Development of Nomographs

A. The Prediction Equation:

This equation was given[1] as:

$$\Delta n = \frac{1 - (n_{i-1}\,\phi_n + G_{i-1}\,\phi_g)}{\phi_n + r_a\,\phi_g} \quad (18)$$

where

$$r_a = (r_i + r_{i-1})/2 \quad (19)$$

It is readily rearranged into this form:

$$(n_{i-1} + \Delta n)\,\phi_n + (G_{i-1} + r_a\,\Delta n)\,\phi_g = 1 \quad (20)$$

In this form, it is seen to be equivalent to the material-balance equation as:

$$n_{i-1} + \Delta n = n_i \quad (21)$$

and

$$G_{i-1} + r_a\,\Delta n = G_i \quad (22)$$

In Equation 20, it is noted that there are four variables:

$(n_{i-1} + \Delta n)$, a function of oil production:

Let this be $f_1(u)$

$(G_{i-1} + r_a\,\Delta n)$, a function of the gas produced with the above amount of oil:

Let this be $f_2(v)$

ϕ_n, a function of reservoir pressure:

Let this fe $f_3(w)$

ϕ_g, a different function of reservoir pressure:

Let this be $f_4(w)$

Thus, Equation 20 can be written as:

$$f_1(u)\,f_3(w) + f_2(v)\,f_4(w) = 1 \quad (23)$$

Note that the pressure, represented here by w is a recurrent variable.

Divide Equation 23 by $f_3(w)$, then

$$f_1(u) + f_2(v)\,\frac{f_4(w)}{f_3(w)} = \frac{1}{f_3(w)} \quad (24)$$

Now let:

$$\frac{f_4(w)}{f_3(w)} = f_5(w)$$

a different function of pressure and

$$\frac{1}{f_3(w)} = f_6(w)$$

another function of pressure.

Equation 24 now becomes:

$$f_1(u) + f_2(v)\,f_5(w) = f_6(w) \quad (25)$$

This form may be represented by a nomograph similar to Fig. 1.

The derivation of this nomograph is as follows:

Take two parallel axes for the variables u and v, and a curved axis in general for the variable w. The line AB, of length K, joins the zero points of the scales for u and v. Points x and y are any points on the u and v scale, $x = m_1\,f_1(u)$ and $y = m_2\,f_2(v)$, where m_1 and m_2 are the respective scale moduli.

Take any index line CD intersecting the scale for w at E. Construct EF parallel to the u and v axes. Let

EF = z and AF = z′. From similar triangles ECH and EDG:

$$\frac{x - z}{z'} = \frac{z - y}{k - z'}$$

$$(k - z')\,x = kz - zz' + zz' - yz'$$

$$(k - z')\,x + yz' = kz$$

$$x + \frac{z'}{k - z'}\,y = \frac{k}{k - z'}\,z$$

Substitute for x and y:

$$m_1\,f_1(u) + \frac{z'}{k - z'}\,m_2\,f_2(v) = \frac{k}{k - z'}\,z$$

$$f_1(u) + (m_2/m_1)\,[z'/(k - z')]$$

$$\times\, f_2(v) = kz/m_1\,(k - z')$$

This equation will become the original equation if $f_5(w)$ and $f_6(w)$ have the following values:

$$f_5(w) = \frac{m_2\,z'}{m_1\,(k - z')}$$

$$f_6(w) = \frac{kz}{m_1\,(k - z')}$$

Solving for z and z′:

$$z = \frac{m_2\,f_6(w)}{f_5(w) + m_2/m_1}$$

$$z' = \frac{k\,f_5(w)}{f_5(w) + m_2/m_1}$$

Points on the curve for the w scale are obtained by taking different values of w and determining the corresponding values of z and z′. These points are plotted and a curve may be drawn through them. The calculations used for the nomograph of Fig. 1 are presented in Table 2 as a sample calculation.

B. The Liquid-Saturation Equation:

The rearranged liquid saturation equation:

$$\text{Log}\,(S_L - K_1)$$

$$= \text{Log}\,K_2B + \text{Log}\,(1 - n_l) \quad (17)$$

is equivalent in form to:

$$f_3(w) = f_1(u) + f_2(v)$$

Let x, y, and z be any points on the scales for u, v, and w, and let m_1, m_2, and m_3 be the scale moduli. Then:

$$x = m_1\,f_1(u)$$

$$y = m_2\,f_2(v)$$

$$z = m_3\,f_3(w)$$

Consider three parallel axes, as in Fig. 7.

Let ABC be a base line, perpendicular to the three scale axes, and let a and b be the distances between scales.

Draw any index line in general, FH, forming similar triangles DEF and DGH, where DE and GH are parallel to ABC.

From these similar triangles:

$$\frac{x - z}{a} = \frac{z - y}{b}$$

which rearranges to:

$$\frac{x}{a} + \frac{y}{b} = \frac{z}{ab/(a + b)}$$

Substituting particular functions for x, y, and z:

$$\frac{m_1\,f_1(u)}{a} + \frac{m_2\,f_2(v)}{b} = \frac{m_3\,f_3(w)}{ab/(a + b)}$$

To reduce this to the original form, let:

$$a = m_1$$

$$b = m_2$$

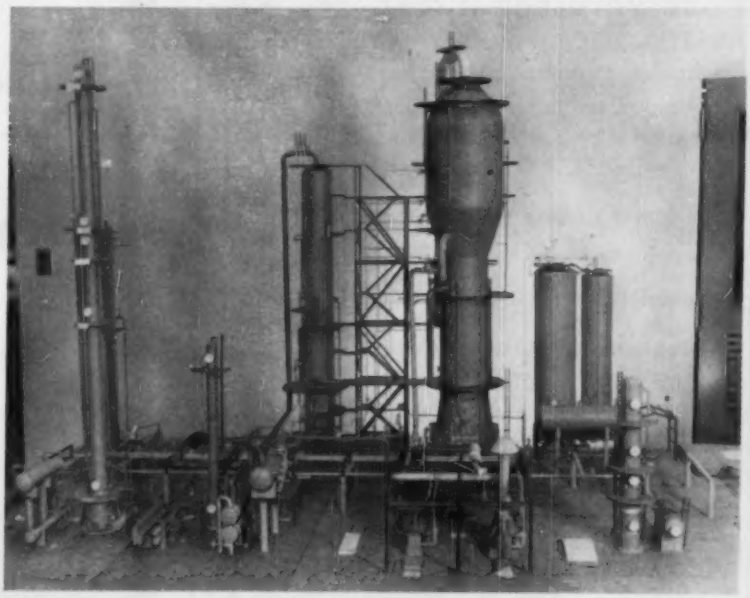
$$ab/(a + b) = m_3' \text{ or}$$

$$m_3 = (m_1\,m_2)/(m_1 + m_2)$$

This also defines the scale moludi in terms of each other, showing that after m_1 and m_2 are selected, m_3 may be completed for them.

To find the position of the center scale in terms of distance between the outside scales, note that the distance from A to B in terms of AC is:

$$a/(a + b)\,(AC) \text{ or } m_1/(m_1 + m_2)\,(AC)$$



B.A. Gets New Cat Cracker

THIS scale model represents the 9,000-bbl. per day Orthoflow catalytic cracking unit going into British American Oil Co.'s new Port Moody refinery, near Vancouver, B. C. The 400-acre site located across Burrard Inlet from Imperial Oil, Inc.'s Ioco refinery, is now cleared and grading has begun.

Canadian Kellogg, a subsidiary of M. W. Kellogg Co., will handle engineering design and construction of the entire refinery. The model, precisely scaled ⅜ in. to 1 ft., is first used to aid in design. At this stage it is ready for review before piping is added. Model construction continues hand in hand with design, so that when engineering is completed, a model of each unit is available for reference by construction personnel.

The refinery will include two-stage crude distillation, catalytic reforming, hydrodesulfurization, and akylation

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OIL WELL PUMPS

TRAVELING PLUNGER ROD TYPE BOTTOM HOLD-DOWN PUMP STANDARD SIZE

Figs. 400P, 600P, 700P, 800P

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TOP HOLD DOWN INSERT ROD PUMP

Standard Size, Figs. 400T, 500T

Self-aligning double plunger insert pumps. Made in three types: combination cup and single plunger; combination cup and double self-aligning type; and metal-to-metal double plunger self-aligning type. All are equipped with Regular or Extra Long Alloy Plungers, ground individually to fit the barrels, assuring longer life on both pump and surface equipment.

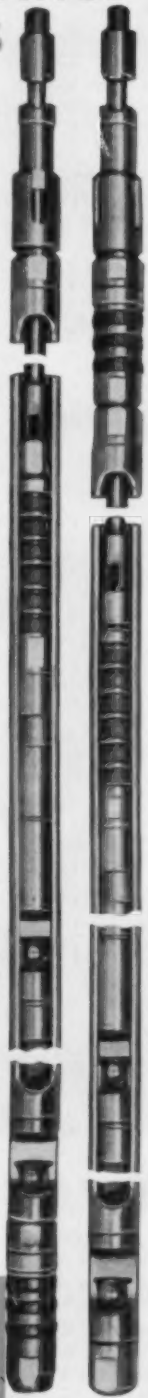

Fig. 400P 600P 700P 800P

Fig. 400T 500T

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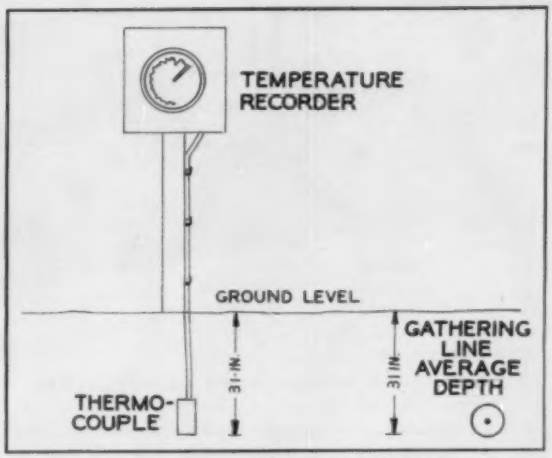


DRAWING of recorder shows typical installation.

COLD-WEATHER TIPS:

Temperature Recorder Serves as Heater Guide

By Larry Resen
District Editor

HERE'S a cold-weather hint for gathering-system operators.

A ground-temperature recorder can be used as an effective guide in determining when to light individual well heaters. An East Texas operator uses such an installation and found it saves gas because heaters aren't turned on prematurely. And it avoids freezeups since an accurate ground temperature is recorded.

Thermostat bulb . . . The installation uses a temperature recorder to plot both ambient and ground temperatures. This latter reading is obtained from a thermostat bulb buried to the average depth of the gather system—31 in. in this case.

When the hydrate temperature of 64° F. is approached, the operator can then make the rounds of the wells tied into the gathering system and fire the heaters. By continuously recording both the ambient and ground temperatures, the temperature recorder indicates the prevailing trend so the operator can be in a good position to estimate whether a cold snap is apt to cause the hydrate temperature to be reached below ground.

Caution . . . Two points to remember in installing a system: (1) be sure you compensate for stream crossings where the pipe may be exposed to ambient temperatures or covered by wet sand, and (2) ground temperature will drop more rapidly if the cold front is accompanied by rain.

Use of this type of installation will save considerable fuel costs. This is especially true where winters are mild and the hydrate temperature might not be reached under ground until late.

Automatic Alcohol-Injection System Prevents Wet-Gas Line Plugging

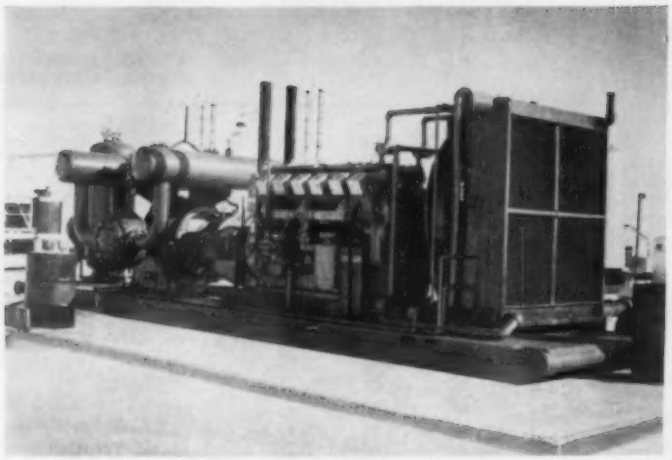
AN automatic alcohol-injection system, actuated by buildup of line pressure, is effective in preventing hydrate plugging of gas-gathering lines.

In one field operation, the wet-gas gathering system, containing water and distillate, was subject to plugging due to hydrate formation in cold weather. Previously alcohol was injected into the system by manual control of the injection pumps. Operators depended upon weather reports as a guide in starting up and cutting off these pumps. This naturally led to high alcohol consumption. It also resulted in occasional freezeups when weather reports were not quite accurate.

Equipment required . . . An automatic system was developed to avoid the drawbacks of manual operation. The equipment required includes a pressure controller, a pressure regulator, a motor valve, an alcohol reservoir (made from empty drums), and the injection pump.

A tap was made on the gathering system upstream of each segment of the line where hydrates were most likely to occur. A line equipped with a tee on one end was tied into this tap. One side of the tee was connected to a pressure regulator, and a second line was tied into the other tee outlet. This second line serves a dual purpose. When alcohol is being pumped, it comes through this second line and passes on into the main line through the tap. A check valve is used on this injection line. However, a third line—the pressure line—is tied in on the tee side of the check valve. This pressure line runs to the pressure controller. The actual line pressure is thus received at the controller via this pressure line.

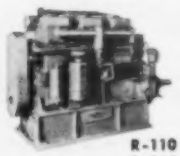
The pressure regulator, meanwhile, steps line pressures down to 100 psi.



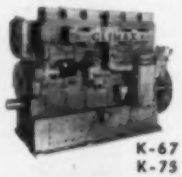
FOR POWERING COMPRESSORS

HORSEPOWER RATINGS[1]											
Model	No. of Cyls.	Bore and Stroke	Cu. In. Displ.	WITH Radiator and Fan				WITHOUT Radiator and Fan			
			(2)	800	900	1000	1030	800	900	1000	1030
R-110	4	6⅛x7	824	58	64	69	71	61	68	75	77
R-165	6	6⅛x7	1238	85	95	103	105	90	101	110	113
K-67	6	7x7	1616	118	131	143	146	122	137	150	154
K-75	6	7½x7	1855	135	151	166	169	139	156	172	176
V-80	8	7x7	2155	153	171	187	190	157	177	193	200
V-85	8	7½x7	2474	181	200	216	221	186	206	224	230
V-122	12	7x7	3232	238	265	288	293	244	272	298	304
V-125	12	7½x7	3711	276	312	340	346	284	319	350	357

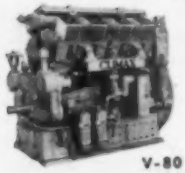
(1) These are continuous duty (API) ratings.
(2) R.P.M.



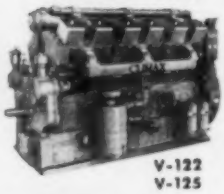
R-110
R-165



K-67
K-75



V-80
V-85



V-122
V-125

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8. All connecting rods are rifle-drilled for pressure lubrication of piston pins (except R series).
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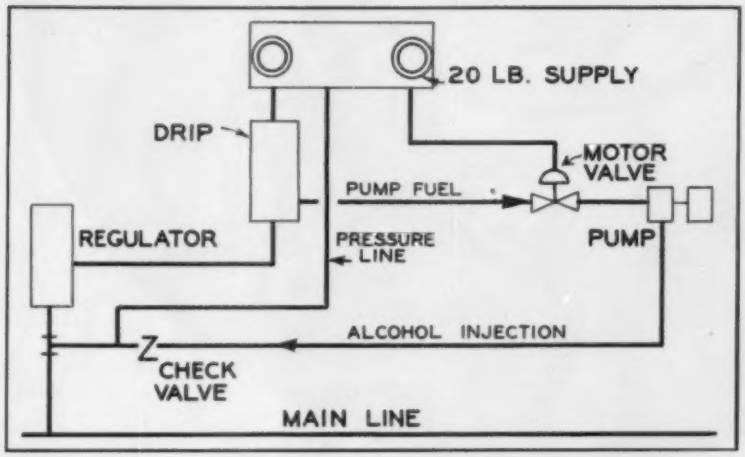


AUTOMATIC alcohol-injection system.

and this gas serves as fuel supply to the alcohol-injection pump. In addition, another stepdown to 20 psi. provides supply gas to the controller. The fuel line to the pump is controlled by a motor valve acting in response to main-line pressure. The motor valve on the fuel line is a diaphragm-closing valve especially selected to prevent any fuel from bleeding when the pump is not operating. Wet line gas is used for fuel, and freezing up of the control would occur if the gas were allowed to bleed continuously.

Type of pump . . . A gas-operated Tex-Steam pump operated off a diaphragm is used to pump alcohol. As noted, this alcohol passes through the alcohol injection line, past the check valve and into the main line. This alcohol also is picked up in the incoming gas as it passes through the tap. The alcohol, when it is being pumped, is hence in the gas which passes through the regulator as well as the gas which enters the pressure controller. In this manner, freezing up of the installation itself is prevented since the alcohol will naturally prevent hydrate formation at these points.

Operation of each injection installation is controlled by line pressure at the tap. The gas-gathering system normally operates at 1,250 psi. When the temperature drops to around 60° F., hydrates will begin forming in the line. As they begin to solidify and choke the line, they will cause a pressure buildup.

When this pressure exceeds a preset limit, the motor valve is actuated, the fuel gas turned into the pump, and alcohol is then pumped into the line. Controls are on snap-action in this operation so that the alcohol injection will begin promptly, permitting alcohol to reach the hydrate quickly before flow is completely stopped. Once the plug has been dispersed, the pressure in the line will drop, and the alcohol system will shut down.

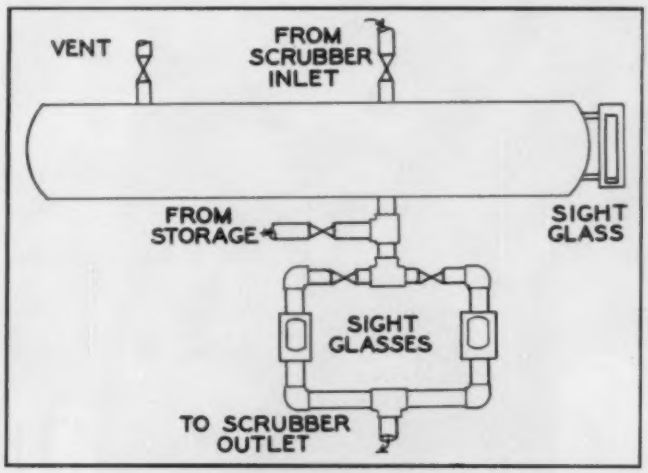
Operation of these units in a Gulf Coast field has resulted in savings of about half in the amount of alcohol normally consumed. More important, their first winter in service was completed without a single line being plugged due to hydrate formation. The controls are simple and the installation is quite economical.

Use Pressure Drop for Alcohol Injection

HERE'S a cold-weather tip for gas-plant operators. You can use the pressure drop across your outlet scrubbers to help in injecting alcohol into the outgoing gas.

One East Texas plant uses a surplus joint of 12-in. pipe, capped at both ends, as an alcohol reservoir when injecting it to prevent hydrate formation. The alcohol drum is equalized with the line pressure by connecting it to the scrubber inlet, on one side and by connecting the outlet from the drum to the scrubber outlet. In this way, there is a pressure drop across the drum equal to that across the scrubbers.

The drum is supported in an elevated position. Thus the head obtained makes it possible to inject alcohol from the drum into the scrubber-outlet line, simply by cracking a valve. In effect, the alcohol gravities into the line.



JOINT of 12-in. pipe acts as alcohol reservoir.

Dual outlet manifold . . . The drum is equipped with a dual outlet manifold, consisting of two runs of piping and two sight glasses. Valves are adjusted manually to provide the desired injection rate as determined by observation through the sight glasses. One or both of the runs are used depending on volume. Use of a sight glass across the drum itself is satisfactory only for filling purposes.

The level drops too slowly across the drum to enable a rate to be determined in this way.

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PIONEER IN CATALYTIC PROCESSES

Final part in this series on Laboratory Testing

JOB IMPROVEMENT FOR THE PROCESS FOREMAN—108

Methods Used for Finished-Product Testing

IN discussing gum content of gasoline we have learned that gum is reported as the weight of gum in a measured volume of gasoline. Another measure of stability is the breakdown time. This is determined by placing a sample of gasoline in a container with oxygen under pressure. Temperature is kept at the boiling temperature of water until the pressure in the container drops. Continuing with other tests for finished products, we will learn first how paraffin wax is sold.

15. Melting point . . . Paraffin wax is sold according to its melting point for many special uses such as: chewing gum, sealing wax, wax paper, candles, etc. This test applies to paraffin wax or to microcrystalline wax. The melting point is the temperature at which the wax changes from a liquid to a solid under conditions of slow cooling and constant stirring.

16. Mercury number . . . The mercury number of a naphtha is a measure of the free sulfur in the sample. The test consists of shaking mercury with the sample of naphtha and comparing the amount of discoloration in the sample with a standard.

17. Mooney viscosity . . . The Mooney viscosity on synthetic rubber is a measure of its resistance to being worked or deformed. A low Mooney rubber with a value below 40 is too soft and fluid to hold its shape. Rubber with a Mooney reading of 50 to 70 above is good innertube material. Rubbers with higher Mooney viscosities are required for tires and hard-rubber products.

The Mooney plastometer is the apparatus used to make the Mooney test. This apparatus consists of two rough disks between which the test sample of raw rubber is twisted. One disk continues to rotate while the other disk is held by a strong spring with a pointer attached. The drag produced by the sample of rubber is shown by the pointer. The harder and more difficult the rubber is to work, the greater will be the pull on the spring and the higher will be the Mooney reading as shown by the pointer.

18. Octane number . . . An octane number is a performance rating used to classify motor fuels. Octane numbers are determined in special one-cylinder test engines. The names octane, isooctane, and 2,2,4-trimethyl pentane are all used to refer to the same pure chemical which is a good motor fuel having a high antiknock rating. This fuel which we will call isooctane was chosen as a standard fuel and assigned a value of 100.

Heptane is a poor motor fuel and knocks badly. It was chosen as the zero reference fuel. The octane number of the fuel sample is the per cent of isooctane that must be blended into heptane to match the knocking tendency of the sample when compared in the test engine. For example, an 80-octane-number gasoline will have the same knocking response in the test engine as a blend of 80 per cent isooctane in heptane.

Tetraethyl lead, a chemical which can be added to finished gasoline, has the property of increasing the octane number. The octane number of the leaded gasoline is determined also by comparison in the test engine with isooctane blended into heptane.

19. Penetration . . . This is a measure of the workability of a road-oil type of material. It is applied to asphaltic type of materials. The test measures the distance a weighted needle will penetrate into a sample of asphalt in a given time and at a controlled temperature.

This same apparatus, using a cone instead of a needle, is used on grease and microcrystalline wax.

20. Softening point. . . . An indication of the temperature at which a road-type of material will start to flow or creep is called the softening point.

The test on asphaltic materials consists of an apparatus which permits the test sample to support a metal ball until the temperature rises to the point where the sample softens and drops the ball. This temperature is the softening point of the asphalt.

21. Sulfur-lamp method . . . Any sulfur, whether locked up in a chemical compound or just free dissolved sulfur when present in a motor fuel, has the property of reducing the effect of the tetraethyl lead in a leaded gasoline. Since tetraethyl is expensive, it is important to know how much sulfur is present in a leaded fuel. The lamp sulfur method will give the total sulfur content.

22. Water and sediment . . . Also known as the b.s. and w. this is a measure of total solids such as dirt, coke, etc., and the water, in a glass tube as percentage of the sample of oil.

Water also can be separated from a sample by distilling the water out and recovering it in a special condenser which catches and measures the water. This too is reported as a percentage of the oil.

23. Other tests . . . Most of the tests applied to oils and gases have been presented in this series. There are other tests which apply to specific unit problems or to finished-product quality that cannot be included. For example, many of the chemical products are produced as essentially pure chemicals so the actual purity is important. Traces of impurities, usually in the range of parts per million for sulfur, chlorine, water, etc., must be identfied by the laboratory and controlled at the units.

End.

This material taken from process-training-program manual, Baton Rouge, La., refinery of Esso-Standard Oil Co.

How Octane Numbers Have Been Improved

By W. L. Nelson
Technical Editor

We note that you scarcely mention octane number in the histories of processing that you have been publishing—S.W.F.

Octane number or ignition quality is so closely related to other developments such as cracking, treating processes that retain the high-octane hydrocarbons, treating processes that eliminate deleterious sulfur compounds, the production of high-octane blending stocks, etc., that no very clear province can be outlined. In addition, octane number contributes little to refinery profit and calls for significant investments. Thus, refiners resist in every way the installation of octane-improvement processes and in many instances wait too long before making the necessary improvements.

Table 1 indicates various significant changes. About the only instances of obsolescence are the following:

1930—Gyro vapor-phase cracking. Use of tetraethyl lead.

1932—Use of gum inhibitors. Gray vapor-phase treating (1930).

1935—Catalytic polymerization. Thermal polymerization (1932).

1940-1941—Desulfurization processes. Some conventional sweetening capacity.

1955—Alkylation for motor fuel. Polymerization (1935).

Methods to Improve Antiknock Quality

The adoption of thermal cracking in about 1915 not only introduced treating and mechanical problems, but it also made the industry aware of the ignition qualities of various hydrocarbons or fuels. Tetraethyl lead was introduced first in 1923, Ethyl Gasoline Corp. was formed in 1924, the use of tetraethyl lead grew by leaps and bounds during 1926, and by 1929 at least 50 oil companies were marketing Ethyl gasoline. This did not cause the highly developed liquid-phase cracking processes to become obsolete because of the constantly increasing demand for gasoline but processes whose usefulness was based on octane number such as the Gyro vapor-phase process (90 research octane-number gasoline), were rendered obsolete. The relatively high octane number of natural gasoline assisted in its adoption as a significant gasoline component during the years 1916-1930. Phillips Petroleum Co. was among the first to capitalize on the value of a "high test" gasoline when it marketed its Phillips 66 (A.P.I.) gasoline.

The customary sulfuric acid treatment of 1925 removed some of the relatively high-octane-number hydrocarbons such as diolefins, olefins, and aromatics and accordingly clay vapor-phase treating was introduced widely in 1930 and oxidation inhibitors were adopted shortly thereafter. The thermal decomposition of hydrocarbons with subsequent thermal polymerization was introduced in 1928 but before it could be widely used it was displaced by catalytic polymerization of olefinic gases in about 1935. Meanwhile, thermal reforming was practiced (1925-1956) on straightrun gasoline for enhancement of its octane number. Not until 1952 was a similar direct method for octane number improvement introduced, i.e., catalytic reforming.

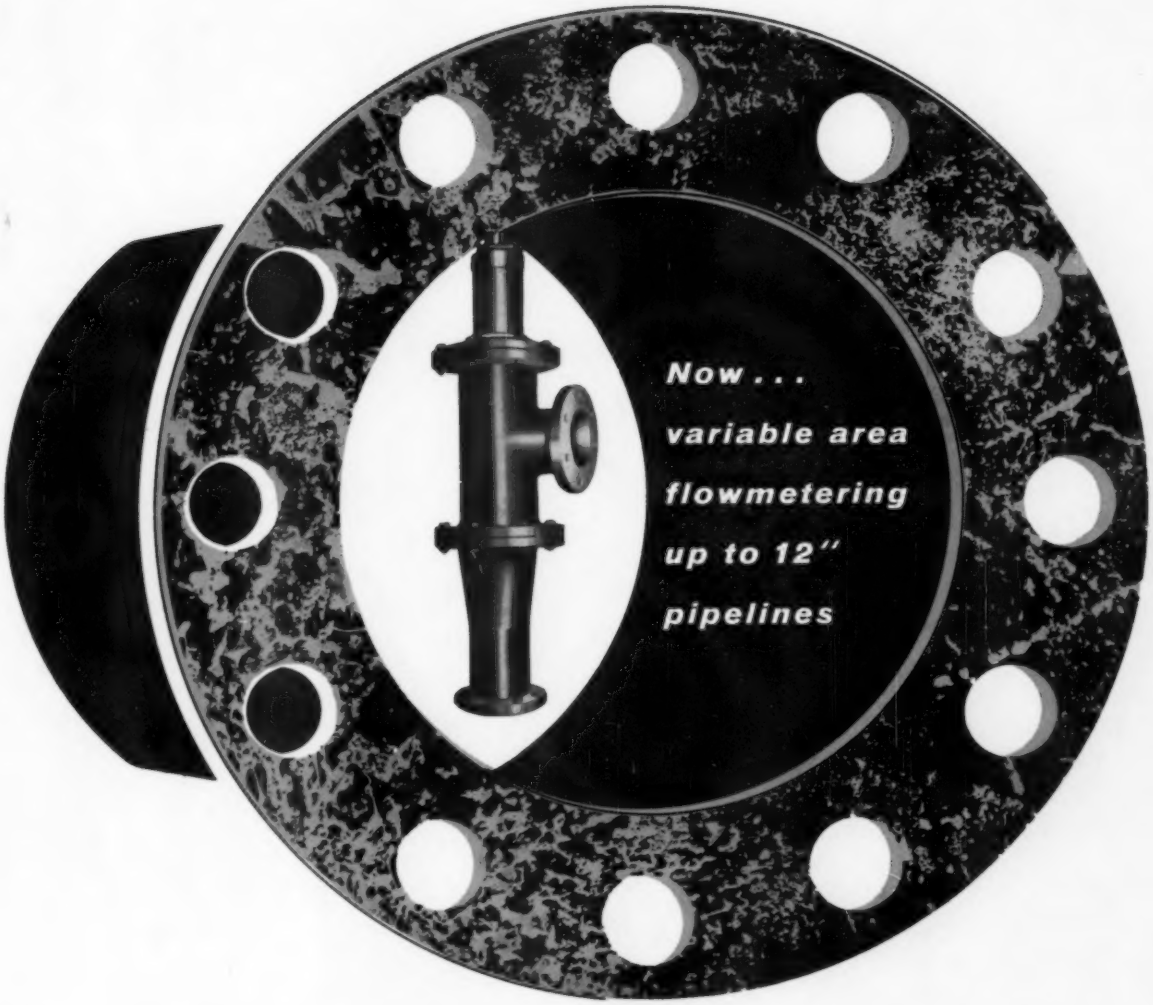
Very small amounts of sulfur cause the susceptibility of gasoline to tetraethyl lead to be poor and accordingly, high-temperature clay desulfurization was adopted by 1940, various caustic extraction processes which remove rather than convert sulfur compounds were used after 1941, and catalytic hydrodesulfurization was introduced in 1953.

Although cracking (thermal or catalytic) is widely considered as means of obtaining high-octane gasoline, it is used mainly because it produces more gasoline from the crude oil. The catalytic processes predominate in part because they produce a gasoline of higher octane number but primarily because they allow the production of less residual fuel oil (and proportionally more gasoline) than does the thermal cracking process.

In a final attempt to increase octane number, such hydrocarbon conversion processes as polymerization (1935), alkylation (1943 and 1953), and possibly isomerization (1957+) are used to produce high-octane blending stocks. Such processes (along with catalytic reforming) are considered by most refiners as a necessary evil because they contribute only to product improvement without materially increasing the refinery income.

TABLE 1—CHRONOLOGY OF OCTANE-IMPROVEMENT PROCESSES

1915	(1910-)	Thermal cracking
1926	(1923-)	Use of tetraethyl lead
1926	(1916-)	High-gravity (high-test) gasoline
1919	(1925-1932)	Gyro vapor-phase cracking for gasoline
1930	(1925-1938)	Gray vapor-phase treating to retain olefins
1930	(1925-1956)	Thermal reforming of naphtha
1932	(1928-1940)	Thermal polymerization
1932	(1928-)	Inhibitors to retain olefins, etc.
1935	(1933-)	Catalytic polymerization
1940	(1935-1950)	High temperature clay desulfurization
1941	(1939-)	Caustic extraction (solutizer) sweetening
1943	(1941-)	Alkylation for aviation gasoline
1952	(1949-)	Catalytic reforming
1954	(1953-)	Hydrodesulfurization
1955	(1953-)	Alkylation for motor fuels
1957+	(1942-)	Isomerization of pentane and hexanes



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mass flowmetering — can be made to read directly in mass flow rates

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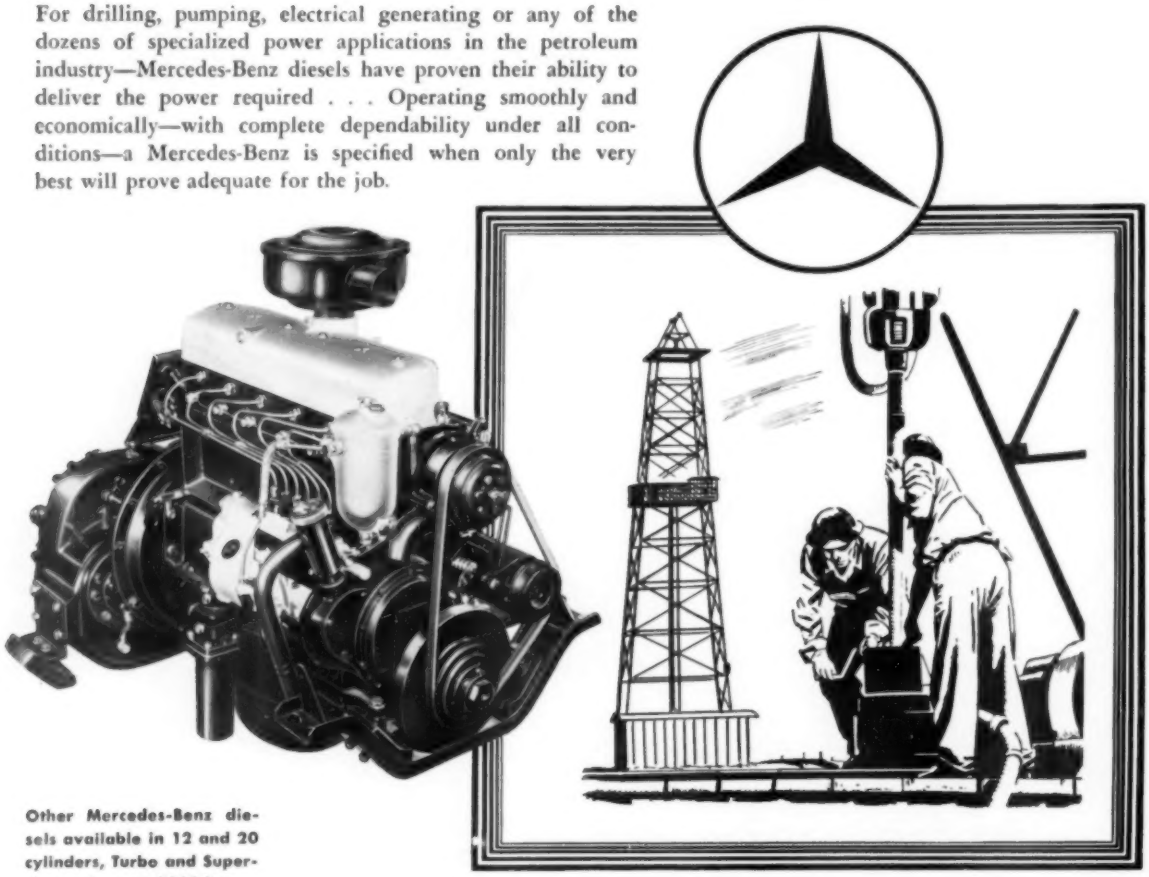

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PIPELINE

CONSTRUCTION REPORT

Who's Laying Line—and Where

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way.

U.S. Crude-Oil Pipelines

- **Belle Fourche Pipeline Co.**
  Project: 30 miles of 6-in. from Donkey Creek pool to Fiddler Creek pool in northeastern Wyo. Will later build a line from Fiddler Creek to connect with Butte Pipe Line Co. near Osage, Wyo.
  Status: Planned.
- **Cape Pipe Line Co.** (Sun Oil Co., Cities Service Co., Atlantic Refining Co.)
  Project: Line from lower Delaware Bay to Philadelphia.
  Status: Planned.
  Completion: 1960.
- **Derby Refining Co.**
  Project: 200 miles of 12-in. from Meade County, Kans., to Wichita.
  Status: Under study.
- **Forest Pipeline Corp.**
  Project: 35 miles of 8-in. from Grieve field, Wyoming, to Platte Pipe Line at Casper.
  Status: Under way.
  Completion: Early December 1957.
- **Four Corners Pipe Line Co.** (Shell, Standard of Calif., Continental, Gulf, Richfield, Superior)
  Project: 635 miles of 16-in. from Aneth field in southern Utah to Los Angeles, 86 miles of 12-in. from New Mexico's Bisti field to Red Mesa station 35 miles southeast of Bluff, Utah, and 3 miles of 6, 8, 10-in. feeder lines from other fields in New Mexico and Utah. Will be operated by Shell Pipe Line.
  Status: Under way.
  Contractor: **A. P. Vaughn Construction Co.** and **Potashnick Construction Co.** have 170 miles of 16-in. from Aneth field to Cameron, Ariz., and 100 miles of 16-in. from Seligman to the Colorado River. **R. H. Fulton & Co.** has comp'eted 98 miles of 16-in. from Cameron to Seligman, Ariz., and has 217 miles of 16-in. from the Colorado River to Olive, Calif., plus river crossing. **Pacific Pipeline Co.** has 46 miles of 16-in. from Olive to Los Angeles. **Standard Pipeline Construction Co.** has feeder lines.
  Completion: February 1, 1958.
- **Gillette Pipeline, Inc.** and **A. W. Hartwig, Inc.**
  Project: A 102-mile line from Dead Horse Creek field to Casper, Wyo.
  Status: Has applied for permit from Wyoming Public Service Commission.
- **Great Northern Railway Co.**
  Project: 400 to 600 miles of 12 to 20-in. from Williston basin in Montana and North Dakota, to Clearbrook or St. Paul, Minn.
  Status: Planned.
  Contractor: **Pipe Line Technologists, Inc.** has completed feasibility study.
- **Magnolia Pipe Line Co.**
  Project: 120 miles of 16-in., 4 miles of 12-in. from Clyde to Midland, Tex.
  Status: Under way.
  Contractor: **O. R. Burden Construction Corp.**
  Completion: December 31, 1957.
- **Muskegon Pipe Line Corp.** (Aurora Gasoline Co., Service Pipe Line Co.)
  Project: 165 miles of 10-in. from Griffith, Ind., to Muskegon, Mich.
  Status: Under way.
  Contractor: **Midwestern Constructors, Inc.** has two spreads working: North end, W. T. Wilhite, supt., office at Coloma, Mich.: South end, R. C. Stanley, supt., office at Chesterton, Ind.
  Completion: December 1957.
- **Offshore Gathering Corp., Houston.**
  Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana. (Dual line.)
  Status: Proposed.
- **Oil Field Pipe Line, Inc.**
  Project: 200 miles 8 and 12-in. line from near Elkhart, to Ellinwood, Kans.
  Status: Proposed.
- **Salt Lake Pipe Line Co.**
  Project: 93 miles of 10-in. loops from Rangely, Colo., to Salt Lake City.
  Status: Under way.
  Contractor: **Engineers Limited Pipeline Co.**
  Completion: December 1, 1957.
- **Shell Oil Co.**
  Project: Undetermined amount of 3, 4-in. in La. Delta area.
  Status: Under way.
  Contractor: **Brown & Root, Inc.**, W. P. Stanley, supt., office at Buras.
  Completion: March 31, 1958.
- **Shell Pipe Line Co.**
  Project: 100 miles of 16 or 20-in. from Delta area of S. La., to Norco, La.
  Status: Planned.
- **Sinclair Pipeline Co.**
  Project: 150 miles of 20-in. from League Tex., to Houston.
  Status: To start December 1957.
  Completion: 1958
- **Skelly Oil Co.**
  Project: 50 miles of 12-in. to replace partially looped 6, 8-in. line between Cunningham and Burton, Kans.
  Status: November 1957.
  Completion: Late 1957.
- **Southern Kansas Pipeline, Inc.**
  Project: 200 miles of 6 to 10-in. in Kans. from southwestern Meade County to 10 miles north of Arkansas City.
  Status: Proposed. Request filed with Kansas Corporation Commission for permit.
- **Texas-New Mexico Pipe Line Co.** (Sinclair, Texas Co., Tidewater, Empire)
  Project: 512 miles of 16-in. from southeast corner of Utah to Jal, N. M.
  Status: Under way.
  Contractor: **Four Way Co., Inc.**, has 150 miles from Aneth field southeast. **Panama, Inc.**, has remaining 362 miles.
  Completion: May 1958.
- **Toronto Pipeline Co.**
  Project: System to connect fields in Cheyenne, Morrill, and Banner counties, Nebr., to Platte Pipe Line Co.'s 20-in. line from Wyoming to Wood River, Ill., and 13 miles of 4-in. plus field lines to Platt's Redding station.
  Status: Planned.

U.S. Products Pipelines

- **Alaska-Yukon Refiners & Distributors, Ltd.**
  Project: Two lines: one 150 miles from Haines to Haines Junction, Alaska, linking with government Canol line; another from Tok Junction, on Canol line, to Anchorage
  Status: Proposed.
  Completion: 1959.

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PIPELINE CONSTRUCTION

• **American Pipe Line Co.**
Project: Line from Gulf Coast to New York City. Has ODM approval to amortize 40 per cent of cost with fast writeoff.
Status: Proposed.

• **Buckeye Pipe Line Co.**
Project: 70 miles of 8-in. from Wayne to vicinity of Durand, Mich.
Status: Under way.
Completion: Early 1958.

• **Clark Oil & Refining Co.**
Project: 15 miles of 8-in. from Blue Island, Ill., to Hammond, Ind., area.
Status: Planned.

• **Columbia Gas System, Inc.**
Project: Line from proposed plant near Kenova, W. Va., to proposed plant and storage facilities at Siloam, Ky.
Status: Planned.

• **Conn-Mass Pipe Line, Inc.**
Project: 62 miles of 8-in. and 7 miles of 6-in. from New Haven, Conn., to Springfield, Mass.
Status: Planned to begin in 1957.
Completion: April 1958.

• **El Paso Natural Gas Co.**
Project: 240 miles of 6-in. from Odessa to El, Paso, Tex.
Status: Under way.
Contractor: **McVean & Barlow, Inc.**, E. J. Miller, supt.
Completion: March 1, 1958.

• **Emerald Pipe Line Corp.**
Project: 120 miles of 6-in. from Sunray, Tex., to Tucumcari, N. M.
Status: Under way.
Completion: December 1, 1957.

• **Everglades Pipe Line Co.**
Project: 60 miles of 10-in. from Port Everglades, Fla., to Miami's International Airport and terminals south.
Status: Under way.

• **Florida Pipeline & Storage Co.**
Project: 67 miles from Everglades, Fla., to Homestead Air Force Base south of Miami.
Status: Under way.
Contractor: **Fish Service Corp.**
Completion: December 1957.

• **Georgia Pipeline Co.**
Project: 7-mile line from Savannah, Ga., to Hunter Air Force Base.
Status: Planned.
Completion: December 31, 1957.

• **Great Lakes Pipe Line Co.**
Project: 15 miles of 6-in. from Lincoln, Neb., to Lincoln air base.
Project: 14 miles of 8-in. from Coffeyville to Independence, Kans., replacing 4-in. line.
Contractor: **Jess Whitlow Pipe Line Service.**
Project: 11 miles of 8-in. from 10 miles east of Donahue, Iowa, to terminals at Bettendorf, Iowa.
Contractor: **R. T. Perry Pipe Line Construction.**

• **Katy and New York Central Railroads**
Project: 2,000 miles of 10 or 12-in. from Houston through Kansas City, St. Louis, Indianapolis and Cleveland to Syracuse then down to New York City. A branch would go through Chicago to Detroit.
Status: Proposed.
Contractor: **Williams Brothers Co.** has feasibility study. Report due December 1957.

• **Laurel Pipe Line Co.** (Gulf Refining Co., Sinclair Pipe Line Co., The Texas Co.)
Project: 100 miles of 24-in. and 340 miles of line graduating down to 14-in. at the west terminus, from Philadelphia to Cleveland.
Status: To start early 1958.
Completion: Summer 1958.

• **Leonard Refineries, Inc.**
Project: 43 miles of 6-in. from Alma to Lansing, Mich.
Status: Planned.
Completion: Late fall 1957.

• **Ohio Oil Co.**
Project: 350-miles of 12-in. from Wood River, and Robinson, Ill., to Chicago.
Status: Under way.
Contractor: **Panama-Williams Corp.** has 84 miles from Robinson to Champaign.
Completion: 1958.

• **Salt Lake Pipe Line Co.**
Project: 80 miles of 8-in. loops from Adams to Ontario, Ore.
Status: Under way.
Contractor: **Halmac Construction Co.**

• **Shamrock Oil & Gas Corp.**
Project: Conversion of 120 miles of 6-in. crude line from Sunray, Tex., to Turpin, Okla.
Status: Under way.

• **Underground Storage & Exploration, Inc.**
Project: 393 miles of 12-in. L.P.G. line from Moundsville, W. Va., to Newark, N. J., plus 95 miles of 6, 8-in. laterals to Mauch Chunk, Pa., and to Philadelphia.
Status: Proposed.

• **Union Oil Co. of California**
Project: 815-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its Rifle shale-oil plant.
Status: Proposed.

U.S. Natural-Gas Pipelines

• **Arkansas Louisiana Gas Co.**
Project: A 300-mile line, plus gathering lines, from Tex.-La. coastal area to northern La., to connect with present system.
Status: Long-range plans

• **Carnegie Natural Gas Co.**
Project: Two parallel lines to provide coke-oven gas to six Pittsburgh area plants: 9 miles of 55-in. and 4 miles of 43-in. each.
Status: To start May 1958.
Contractor: **Williams Brothers Co.**
Completion: November 1958.

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PIPELINE CONSTRUCTION

• **Carolina Pipeline Co.**
Project: 177 miles of 2, 3, 4, 6, 8, and 10-in. between Blacksburg and Camden, S. C.
Status: Under way.
Contractor: **Panama-Williams Corp.** and **P. A. Buchanan** have construction contract. **Coates Field Service, Inc.** has right-of-way acquisition and claims settlement contract.

• **Central Hudson Gas & Electric Corp.**
Project: 46 miles of 10-in. from Albany to Kingston, N. Y.
Status: Under way.
Contractor: **Williams-Austin Construction Corp.,** O. L. Martin and Ralph Gaddy, supts., office at Catskill, N. Y.
Completion: December 1, 1957.

• **Chicago District Pipeline Co.**
Project: 52 miles of 30, 36-in. between Joliet and Chicago, Ill.
Status: Approved.
Completion: 1958.

• **Cities Service Gas Co.**
Project: 75 miles of 30-in. from Independence to near Welda, Kan.
Status: Under way.
Contractor: **R. H. Fulton & Co.**
Completion: December 1957.

• **Coastal States Gas Producing Co.**
Project: A 20-mile gathering system from the Rock Island area of Colorado County, Tex., to the United Gas Corp. system.

• **Coastal States Gas Producing Co. and Southern Coast Corp.**
Project: 45 miles of 2 to 10-in. in Bee County, Tex. to connect presently shutin fields with Texas Eastern Transmission Corp.'s system.
Status: Planned.

• **Coastal Transmission Corp.**
Project: 575 miles of 12, 20, 22, 24-in. main line and 414 miles of 2 to 14-in. gathering lines between McAllen, Tex., and Baton Rouge, La.
Status: Under way.
Completion: January 1, 1958.

• **Colonial Natural Gas Corp.**
Project: Two systems; one between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.
Status: Proposed.

• **Colorado Interstate Gas Co.**
Project: 1957 program . . . 66 miles of 30-in., 40 miles of 34-in., 109 miles of 26-in., and 100 miles of 24-in. from Springfield, Colo., to Pueblo, Colo; 345 miles of 30-in. from Kit Carson, Colo., to Beatrice, Neb.; 24 miles of 22-in. Panhandle field looping.
Status: Approved.

• **Eastern Shore Natural Gas Co.**
Project: 34 miles of 8-in. and 90 miles of 6-in. from connection with Transcontinental Gas Pipe Line Corp. in Maryland, across entire length of Delaware to Salisbury.
Status: Pending FPC approval.

• **El Paso Natural Gas Co.**
Project: 177 miles of 20-in. from Sonora Plant, Sutton County, to Plains Plant, Yoakum County, Texas.
Status: Planned. Filed for FPC permit.
Completion: January 1958.
Project: 74 miles of 30-in. Permian-San Juan main line loops.
Status: Planned. Filed for FPC permit.
Completion: January 1958.
Project: 216 miles of 6 to 34-in. and 533 miles of various size in Ariz., Tex., N. M.
Status: Filed for FPC permit.
Project: 47 miles of 30-in. from proposed Lindrith, N. M., plant to proposed Chaco, N. M., plant.
Status: Under way.
Contractor: **Foutz & Bursum Construction Co.**
Completion: 1957.
Project: 38 miles of various size line to make additional gas available at the McElroy-Wilshire plant near Crane, Tex.
Project: 500 miles of 34-in. from Twin Falls, Idaho to California border near Las Vegas, Nev.
Status: Planned.
Completion: September 1, 1959.
Project: 131 miles of 4, 6, 8, 10, 12, 16, 18 and 20-in. gathering lines in Gray, Wheeler, and Collingsworth counties, Texas Panhandle.
Status: Under way.
Contractor: **R. H. Fulton & Co.**
Completion: Late 1957.

• **Houston Texas Gas & Oil Corp.**
Project: 702 miles of 24-in. from Baton Rouge, La., to Kissimmee, Fla.; 139 miles of 18-in. and 101 miles of 20-in. from Kissimmee to Cutler, Fla.; 642 miles of 3 to 18-in. sales laterals in Florida. Main line to join Coastal Transmission's line from McAllen, Tex., to Baton Rouge.
Status: Underway.
Contractor: **Midwestern Constructors** has the 702 miles of 24-in.; **Harbert Construction Corp.** has remainder.
Completion: June 1958.

• **Iron Ranges Natural Gas Co., St. Paul.**
Project: 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minn.
Status: Application pending with FPC.

• **Kansas-Nebraska Natural Gas Co.**
Project: 61 miles of various size gathering line in Camrick field, Texas County, Okla.
Status: Approved.

• **Kerr-McGee Oil Industries, Inc.**
Project: 24 miles of 4-in. in Blocks 21, 22, and 32 to connect wells with its Breton Sound production island off the Louisiana coast.

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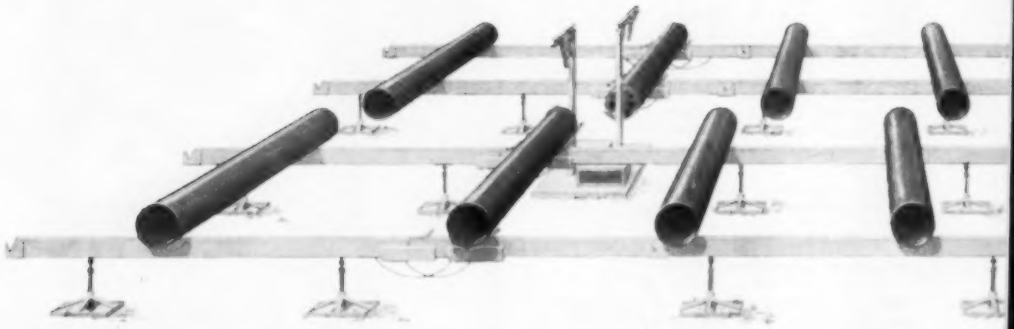

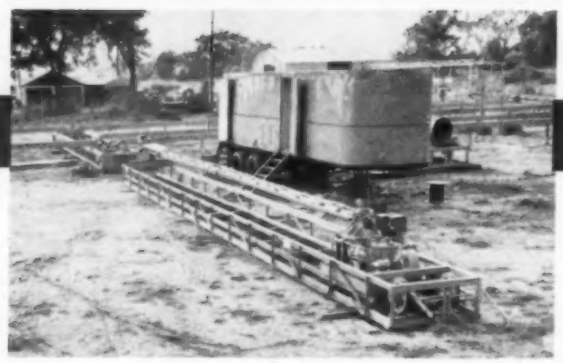

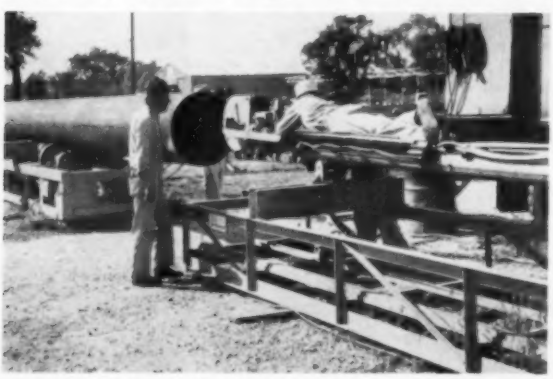

Through the outstanding facilities and skilled specialists provided by Crose engineering, new and important equipment now is available to the pipeline industry. Crose, the recognized leader in its field, in collaboration with another great industry name, has designed and perfected a fully automatic double jointer for large diameter pipe. This highly portable equipment, set up in strategically located yards, brings finest shop techniques to the field through controlled welding conditions never before possible.

The CROSE-PRICE-O-MATIC fully automatic double jointer speeds up pipe laying — only half as many manual welds now required out on the line. Maximum automation of pipe handling equipment and highest quality automatic welding — even in sub-zero weather — effect tremendous savings in time and labor, which means greater economy and efficiency for the pipeline industry.

AUTOMATIC PIPELINE WELDING

UNDER CONTROLLED CONDITIONS FOR MAXIMUM QUALITY AND ECONOMY

double jointer

CROSE-PRICE-O-MATIC

fully automatic

Pipe is rolled onto skidways to grinding station where 75% of the bevel is ground off by special electric-powered grinding units. Pipe then is rolled to welding station where line-up and handling are accomplished hydraulically. At the automatic welding station — including synchronized turning rollers — two outside beads are run. Pipe is rolled to the next rack for the inside bead, which is quickly achieved by a boom that projects welder and welding head into pipe. Turning rollers revolve pipe around welder and boom. Both outside and inside beads are run by submerged arc welding heads. For 30-inch pipe the production rate is ten to twelve welds per hour with the Crose-Price-O-Matic double jointing process. Welding time varies slightly with the size of pipe. Handling time into and out of welding fixture remains constant. This equipment is designed to handle pipe 24″ to 36″ in diameter.

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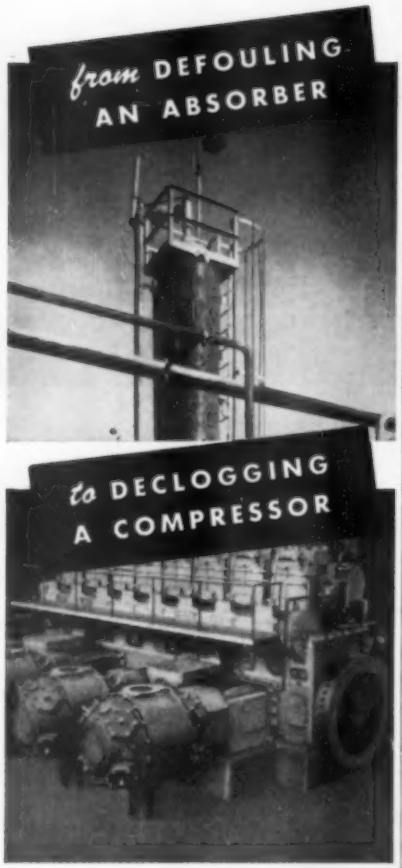

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Removing asphaltic deposits manually from 45 ft. tower took toll of 4 days production for shutdown. Oakite chemical circulation method cut time to 20 hours, production loss to less than a day, and cost only ⅛ as much.

Clogging deposits disappear without need for dismantling compressors by pumping Oakite de-sludging and descaling solutions through equipment. In addition, the Oakite Man showed one refiner how compressors could subsequently be kept *free* from scale, eliminating 12 hours shut-down *every* 6 to 8 weeks.

These are but 2 of many ways to save time, trouble and expense with tested Oakite methods and materials. Others are concisely discussed in Booklet F-7629. Write Oakite Products, Inc., 44C Rector Street, New York 6, N. Y.

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PIPELINE CONSTRUCTION

• **Manufacturers Light & Heat Co.**
Project: 3 miles of 12-in. from Wellsville to a point in Saline Township, Ohio; 8 miles of 12-in. in Brook County, W. Va.; 4 miles of 10-in. in Ohio County, W. Va.
Status: Has temporary FPC authority.

• **Michigan Consolidated Gas Co.**
Project: 67 miles of 10 and 12-in. between Sears and Travers City, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.**; Floyd Huduall, supt., office at Cadillac.
Project: 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.**, jointly with **H. L. Gentry Construction**, Frank Morris, superintendent, office at Hart, Mich.

• **Michigan Gas Storage Co.**
Project: 40 miles of 12-in. and 12 miles of gathering lines from Overisal field in Allegan County to Kalamazoo, Mich.
Status: Planned.
Contractor: **Bechtel Corp.**

• **Midwestern Gas Transmission Co.**
Project: Will build main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in., plus 648 miles of ½ to 18-in. extensions in Minn. and Wis.
Status: Application pending with FPC.

• **Mountain Fuel Supply Co.**
Project: Extension of 12-in. line from Ogden to Logan and Brigham City, Utah.
Status: Has applied to Utah Public Service Commission.
Completion: Late 1957.

• **Natural Gas Pipeline Co. of America**
Project: 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch, Tex., plus a gathering system.
Status: Under way.
Contractor: **R. H. Fulton & Co.** has Red River crossing in northern Montague County. **Fulton & Brodie, Inc.**, has gathering system. **Eastern Pipeline Contractors** has completed 86 miles of 20-in. from Bridgeport, Tex., to Healdton, Okla. **River Construction Corp.** has 86 miles of 26-in. from Mountain View, Okla., to Wheeler, Tex., Henry Arthur, spread supt., office at Hobart, Tex., and 87 miles of 26-in. from Wheeler to Fritch, Tex., D. C. White, supt., office at Pampa, both to be completed December 1, 1957. **H. B. Zachry Co.** has 88 miles of 26-in. between Ringling and Mountain View, Okla., Aldress Kilgore, supt., office at Duncan, to complete November 15, 1957.
Completion: January 1, 1958.
Project: 389 miles of 36-in. loops along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co., and 91 miles of 30-in. loops along parts of its main line.
Status: Approved by FPC examiner.
Project: 337 miles of 30-in. between Fritch, Tex., and Beatrice, Neb., and 59 miles of 16-in. between Beatrice and Joilet, Ill., along existing system.
Status: Pending FPC approval.
Completion: 1959.

• **Niagara Mohawk Power Corp.**
Project: 196 miles of 2 to 16-in. transmission and distribution mains to service areas in central, eastern and northern New York.
Status: Under way.
Contractor: Various.
Completion: December 31, 1957.

• **North Carolina Natural Gas Corp.**
Project: 630 miles of 2 to 16-in. from near Mooresville, eastwardly across N. C.
Status: Under way.
Completion: Spring 1958.

• **Northern Natural Gas Co.**
Project: 160 miles of 2, 3, 6, 8-in. branch lines to serve 20 new communities on Aberdeen, S. D., line.
Status: Under way.
Contractor: **Troth Construction Co.**
Project: 73 miles of 20-in. from Savanna Creek to Pincher Creek fields in Alberta, Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.
Status: Proposed.
Project: 365 miles of main line and 1,090 miles of branch lines to serve communities in Minn., Iowa, S. D., Nebr., Wis.
Status: Filed with FPC March 18, 1957.
Project: 85 miles of 24 and 30-in. loops between Sunray, Tex., and Sioux City, Iowa.
Status: Under way.
Contractor: **R. H. Fulton & Co.**
Completion: December 1957.
Project: 13 miles of 16-in. to replace existing 10-in. line in Hansford County, Texas.
Status: Has temporary FPC authority.

• **Northern Utilities Co.**
Project: 35 miles of 16-in. in Fremont-Natrona County, Wyo., area; 8 miles of 12-in. around Casper; 6 miles of 8-in. from Sand Draw gas field to Beaver Creek field; 12 miles of 6-in. from Beaver Creek field to the system servicing the Riverton-Lander area.
Status: Planned.

• **Offshore Gathering Corp.**, Houston.
Project: 364 miles in Gulf of Mexico off Louisiana: 60 miles of 24-in., 70 miles of 26-in., 234 miles of 30-in. (Dual line.)
Status: Application pending with FPC.

• **Ohio Fuel Gas Co.**
Project: 30 miles of 24-in. looping from Pavonia to Attica, Ohio.
Status: Under way.
Completion: November 25, 1957.

• **Oklahoma Natural Gas Co.**
Project: 9 miles of 2, 6, 8-in. between Stroud and Bristow, Okla.
Status: Under way.
Contractor: **Trojan Construction Co., Inc.**, W. R. Moreland, supt., office at Bristow.
Completion: November 15, 1957.

• **Olin Gas Transmission Corp.**
Project: 20 miles of 10-in. and a Mississippi River 3 and 8-in. crossing near White Castle, La.
Status: Under way.
Contractor: **Houston Contracting Co.**, A. J. Slovack and R. E. Thornton, supts. office at White Castle.

• **Pacific Gas & Electric Co.**
Project: 138 miles of 34-in. looping of the Topock-Milpitas line.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.**
Completion: December 1, 1957.
Project: 5 miles of 16-in., 160 miles of 12-in., 8 miles of 6-in. from Corning to Eureka, Calif.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.** and **Alex Robertson Co.**
Completion: January 1, 1958.

• **Pennsylvania Gas Co.**
Project: 23 miles of 10-in. in Erie County, Pa., 15 miles of 8-in. in Warren and Chautauqua counties, Pa., 30 miles of branch lines, several small distribution lines.
Status: Has FPC permit.

• **Permian Basin Pipeline Co.**
Project: 83 miles of 16-in. from its Spraberry station in Midland County, Tex., to tie in with Pioneer Gathering System, Inc. in northwestern Schleicher County, Tex.
Status: Under way.
Contractor: **Lone Star Constructors, H. A.** (Red) Wylie, supt.
Completion: November 1957.

• **Phillips Petroleum Co.**
Project: 30 miles of 3 to 8-in. in Moore, Hutchinson, Sherman, Hansford, and Gray counties, Tex., and in Texas County, Okla.
Status: Planned.

PIPELINE CONSTRUCTION

Contractor: Various.
Completion: January 1, 1958.

• **Piedmont Gas Co.**
Project: 78 miles of 2 to 8-in. extension off Trancontinental in North Carolina to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.
Status: Has FPC approval.

• **Southern Natural Gas Co.**
Project: 10 miles of 8-in. laterals in Napoleonville Field and Fort Jackson Field, La.
Status: Has FPC approval.
Completion: December 1, 1957.
Project: 32 miles of 6-in. from Chandeleur Sound area, Breton Island, La.; 7 miles of 8-in. and 5 miles of 10-in. from Main Pass area to Olga, La.; 9 miles of 8-in. from Bastian Bay Field to Fort Jackson Field; 7 miles of 8-in. laterals in Manila Village Field.
Status: Has FPC approval.
Completion: December 1, 1957.
Project: 14 miles of 24 and 26-in., 62 miles of 20-in., 48 miles of 16-in., 21 miles of 12-in., 14 miles of 10-in., and 51 miles of smaller lines in La.
Status: Pending FPC approval.

• **Tennessee Gas Transmission Co.**
Project: 71 miles of 26-in., 10 miles of 20-in., 16 miles of 16-in., and 10 miles of 12-in. gathering lines from near Kinder, La., southward to offshore fields in Gulf of Mexico.
Status: Under way.
Contractor: **Brown & Root, Inc.** has all except for 50 miles of 26-in., C. M. Spears, supt., office at Lake Charles.
Completion: December 1, 1957.
Project: 556 miles of 30-in. from Mississippi Delta area south of New Orleans to Portland, Tenn.
Status: Pending FPC approval.
Project: 76 miles of 24-in. from Coudersport, Pa., to Hamburg, N. Y.
Status: Pending FPC approval.
Project: 163 miles of 30-in. and 101 miles of 26-in. from Portland, Tenn., to near Lancaster, Ky.; from Winchester, Ky., to Morehead, Ky.; from Catlettsburg, Ky., toward Broad Run, W. Va.; from New Wilmington, Pa., to Mercer, Pa.; and from Morehead, Ky., to Catlettsburg, Ky.
Status: Pending FPC approval.

• **Texas Eastern Transmission Corp.**
Project: 17 miles of 8-in. and 3 miles of 6-in. from its 20-in. Baytown-Hankamer line to Alco-Mag field in Harris County, Texas.
Status: Has FPC approval.
Project: 140 miles of 30-in. between Kosciusko, Miss., and Uniontown, Pa., 105 miles of 30-in. between Opelousas, La., and Kosciusko, 22 miles of 14-in. supply line in La.
Status: Pending FPC approval.

• **Texas Illinois Natural Gas Pipeline Co.**
Project: 44 miles of 36-in. and 4 miles of 34-in. from south of Joliet, Ill., to Howard Street, west of Chicago.
Status: Under way.
Contractor: **Midwestern Constructors, Inc.**, John Work, supt., office at Aurora.

• **Transcontinental Gas Pipe Line Corp.**
Project: 172 miles of 36-in., 68 miles of 30-in., 162 miles of 24-in., and 64 miles of smaller size loops from Tex. to N. J.
Status: Work in North Carolina under way.
Contractor: **Western Construction Co.** has 65 miles of 36-in. and 45 miles of 30-in. at scattered spots along system in S. C., N. C., Pa., and Va. Work will start in N. C., office at Winston-Salem.
Completion: December 1957.
Project: 110 miles of 36-in., 16 miles of 30-in., and 13 miles of 24-in. looping in S. Car., Ga., Ala., Miss., and La.
Status: Under way.
Contractor: **Sharman, Allen, Gay & Taylor, Inc.**, E. D. Singleton, superintendent.
Completion: November 1957.
Project: 57 miles of 30, 36-in. loops in La., Miss., Ala., Ga., S. C., and 247 miles of mostly 24 and 16-in. laterals in Tex. and La.
Status: Under way.
Contractor: **H. B. Zachry Co.** and **Panama-Williams Corp.** have gathering lines.
Completion: January 1958.
Project: 87 miles of 24-in. laterals, plus small gathering lines connecting seven Louisiana fields with the New Orleans area.
Status: Pending FPC approval.

• **Trans-Western Pipe Line Co.** (Warren Petroleum, Monterey Oil Co., J. R. Butler.)
Project: A line from Four Corners area to Calif. border.
Status: Proposed.

• **United Gas Pipe Line Co.**
Project: 18 miles of 12-in. from Lirette-Mobile line in Jackson County, south to Bayou Casottee industrial area east of Pascagoula, Miss.
Status: Approved.
Project: 202 miles of 30-in. loop from southeast Louisiana, to Mobile, Ala.
Status: Pending FPC approval.
Project: 16 miles of 10-in. near Dayton, Tex.
Status: Under way.
Contractor: **Houston Contracting Co.**, L. A. Young, supt., office at Dayton.

Canadian Crude-Oil Pipelines

• **Act Oils, Ltd.**
Project: A 450-mile line from the Peace River region of northern B. C. to tidewater at Bella Coola, B. C.
Status: Request has been made for permit from the B. C. government.

• **B-A Alberta Pipe Line, Ltd.**
Project: 35 miles of 8-in. to connect Drum-

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PIPELINE CONSTRUCTION

heller field, Alberta, with existing lines running to Edmonton.
Status: Pending approval.

• **Gibson Petroleum Co., Ltd.**
Project: 25 miles of line from Willesden Green field to near Rimbey, Alta.
Status: Has Alberta Government approval.

• **Royalite Oil Co., Ltd.**
Project: 250-mile line from Athabasca oil sands, northeastern Alta., to Edmonton.
Status: Long range plans.
Completion: 1960.

• **Westspur Pipe Line Co.**
Project: 20 miles of 12-in. from Alida in southeastern Saskatchewan, to the Carnduff-Glen Ewen area to tap Cantal, Hastings, Florence, Carnduff, and Glen-Ewen fields. 34 miles of 4, 6, 8-in. gathering lines.
Status: Has requested permit from Board of Transport Commissioners.
Contractor: **Majestic Contractors, Ltd.**, Jeff Minter, supt., office at Estevan, Sask.
Completion: No date set.

Canadian Products Pipelines

• **Hydrocarbons Pipeline Co.**
Project: 800 miles of 6 and 8-in. LPG line from near Edmonton, Alta., to Fort William, Ont.
Status: Has permit from Parliament of Canada. If approved by Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board, work will start in 1957.
Construction consultants: **Dutton-Williams Brothers, Ltd.**, and **A. D. Little Co.**

Canadian Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co., Ltd.**
Project: 637 miles of 34 to 16-in. gathering lines in Alberta.
Status: Under way.
Contractor: **Dutton-Williams Brothers, Ltd.** has preliminary studies, design and management-engineering. **Universal Pipe Line, Ltd.** subsidiary of Mannix, Ltd., jointly with **Marine Pipeline & Dredging Co.**, has crossing of Red Deer River near Cavendish, Alta., J. Hysuick, spread superintendent, office at Empress. **Fulton Banister, Ltd.**, has completed 17 miles of 34-in. west from Burstall, Sask., to near Cavendish, Alta., and 100 miles of 18-in. north to Bindloss and Provost fields.

• **Alberta & Southern Transmission Co., Ltd.**
Project: 1,300 miles of 36-in. from Alberta to San Francisco area plus 47 miles of gathering lines.
Status: Planned.
Completion: 1960.

• **Goliad, Ltd.**
Project: 28 miles of 4, 8-in. in Pembina field.
Status: Under way.
Contractor: **Henuset Brothers, Ltd.**
Completion: November 30, 1957.

• **Northern Ontario Pipe Line Crown Corp.**
Project: 675 miles of 30-in. from the Ontario-Manitoba border to near Kapuskasing, Ont. (part of the 2,250-mile Trans-Canada line; will be leased to Trans-Canada Pipe Line Co. with option to buy.)
Status: Under way.
Contractor: **Dutton Williams Brothers** has 58 miles from the Manitoba-Ontario border west of Kenora to a point east of the crossing of Ontario Highway 17. **Morrison Shivers, Ltd.** has 94 miles from the east crossing of Highway 17 to a line separating the townships of Hyndman and Hodgson. **Majestic Contractors, Ltd.**, and **Nelen, Ltd.**, have completed 80 miles from the Morrison Shivers terminal to Stedman Township. **Houston Contracting Co.** has completed 79 miles from Stedman to Forham Township. **River Construction Corp.**, has Winnipeg River crossing near Kenora, Ont., to complete November 15, 1957.
Completion: End 1957.

• **Ottawa Gas Co.**
Project: 36 miles of 12-in. from Morrisburg to Ottawa, Ont.
Status: Under way.
Contractor: **Majestic Contractors, Ltd.**
Completion: Before end 1957.

• **Trans-Canada Pipe Lines, Ltd.**
Project: 310 miles of 20-in. from Toronto to Montreal, 33 miles of 24-in. from Toronto to Niagara, N. Y.
Status: Under way.
Contractor: **Oklahoma Pipe Line Constructors** (83 miles of 20, 24-in. from Toronto to Whitby, Ont., completed); **Grayco Constructors, Inc.** (120 miles of 20-in. between Toronto and Montreal). **Dutton Williams Bros.** (114 miles between Toronto and Montreal).
Completion: Late 1957.

• **Union Gas Co. of Canada, Ltd.**
Project: 142 miles of 26-in. from Dawn Township to Hamilton, Ontario, plus 55 miles of 6 to 20-in. laterals, and 317 miles of 2 to 12-in. distribution lines.
Status: Under way.
Contractor: **Canadian Bechtel, Ltd.** has the 26-in. line with 2 spreads working: J. L. Work, supt., office at Galt, H. F. Mogg, supt., office at Strathroy.
Completion: 1958.

• **Westcoast Transmission Co., Ltd.**
Project: 42 miles of 20-in. and 100 miles of 30 in. from Savanna Creek area, Alta., to Canadian-Idaho border.
Status: Planned.
Completion: November 1, 1958.
Project: Looping of present system to double capacity.
Status: Planned.

Foreign Crude-Oil Pipelines

• **Assam Oil Co.**
Project: 600 miles of 20-in. from Nahorkatiya field in Upper Assam to Barauni, India, to connect with Burmah Oil Co.'s proposed 250-mile line from Barauni to Calcutta.
Status: Survey of possible routes under way.
Contractor: **Pipe Line Engineering Co.** is making survey.

• **Bolivian Gulf Oil Corp.**
Project: 160 miles of 10-in. and 43 miles of 8-in. from Sicascia to Arica on the Chilean coast.
Status: To start late 1957.
Contractor: **Williams Brothers Co.**
Completion: 1958.

• **Bolivia-Paraguay**
Project: 500 miles of 6-in. from Southeast Bolivia to a proposed refinery on Paraguay River, and later to Asuncion.
Status: Planned.
Contractor: Five Lilles, a French Combine.

• **Burmah Oil Co., Ltd.**
Project: 250 miles of 20-in. from Barauni to Calcutta, India, extending Assam Oil Co.'s proposed line.
Status: Survey under way.
Contractor: **Collins Construction Co.** is surveying locations for some 40 river crossings.

• **Caltex**
Project: 30 miles of 30-in. from Duri field in Sumatra to Dumai where a deepwater terminal will be built. Line will be extended 35 miles to Minas field later.
Status: Under way.
Contractor: **Bechtel Corp.**
Completion: May 1958.

• **Colombian Petroleum Co.**
Project: 42 miles of 6-in. from Tibu field to Rio de Oro in Colombia.
Status: Under way.

• **C.R.E.P.S., Societe Nationale de Recherche et d'Exploitation des Petroles en Algerie (SN Repal), and Cie. Francaise des Petroles Algerie**
Project: 105 miles of 6-in. from Hassi Messaoud and Edjele, Algeria to the railhead at Touggourt.
Status: Planned.
Completion: 1958.
Project: 450 miles of 16-in. from Edjele field in southeastern Algeria to a Mediterranean port on the Libyan coast.
Status: Pipe has been ordered.

• **Creole Petroleum Corp.**
Project 100 miles of 30-in. from Temblador field to Caripito in Venezuela.
Status: To start work early 1958.
Contractor: **Pipe Line Engineering Co.** and **Oklahoma Pipe Line Constructors**, R. J. O'Connell, supt., office at Maturin.
Completion: April 30, 1958.

• **Elburz Oil Corp.**
Project: 1,000 miles of 38-in. to move Qum crude to the Mediterranean.
Status: Planned.

• **Iranian Consortium**
Project: 30 miles of 20-in. and 22 miles of 16-in. looping of Agha Jari to Bandar Mashur line.
Status: Planned.
Project: 50 miles of 26, 28-in. from Gach Saran field to new terminal on Persian Gulf.
Status: Planned.

• **Iraq Petroleum Co.**
Project: About 600 miles of up to 40-in. from Kirkuk field through Iraq to Turkish port of Iskenderun on the Mediterranean.
Status: Proposed. Survey completed.

• **Mene Grande Oil Co.**
Project: 97 miles of 30-in. from fields in Eastern Venezuela to Puerto La Cruz.
Status: Under way.
Contractor: **Fulghum Contracting Corp.** has 22 miles between Oficina and Anaco. **Williams Brothers** has remainder.
Completion: First quarter 1958.
Project: 45 miles of 24-in. from Oficina to Melones, Venezuela.
Status: Planned.
Completion: First quarter 1958.

• **Middle East Pipeline**
Project: 1,500 miles of 38 and 40-in. line from Persian Gulf to Mediterranean at Iskenderun, Turkey.
Status: Proposed.

• **North-West Oil Pipeline Co.** (newly formed by six West German refiners, headed by affiliates of Standard Oil Co. (N.J.), and British Petroleum Co., Ltd.)
Project: 230 miles of 28-in. from refining centers in the industrial Ruhr area of West Germany to Wilhelmshaven.
Status: Work to start early 1958.
Completion: November 1958.

• **Royal Dutch-Shell**
Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through Eastern France, Luxembourg, West Germany, and Netherlands, and Belgium. Main trunk to be 30-in.
Status: Company is considering project together with several other companies.

• **Standard-Vacuum Petroleum Maatschappij.**
Project: 94 miles of 8-in. from Lirik field, Central Sumatra, to deep-water terminal on Siak River, near Buatan. A 3-in. hot-water "defroster" line will be laid under the 8-in. to heat the heavy crude.
Status: Under way.
Completion: Late 1957.

• **Ste. Nationale de Recherche et d'Exploitation des Petroles en Algerie**
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move oil from Hassi Massaoud field. Two routes possible: 200 miles from the field northwest to Laghouat; 260 miles from the field to the north and slightly east to Biskra.
Status: Under study.

• **Union of Soviet Socialist Republic**
Project: 2,300-mile Trans-Siberian crude-products line from Ufa Tuimaza fields in Bashkiria to Irkutsk near Lake Baikal.

• **Yacimientos Petroliferos Fiscales (Argentina)**
Project: 932 miles of 12-in. from Campo Duran to San Lorenzo.
Status: Planned.
Contractor: **TIPSA** (Fish Engineering Corp., Fish Northwest Constructors, Inc., Clark Brothers, North American Utility, Construction International Co.).
Project: 625 miles of 12-in. from Mendoza to San Lorenzo.
Status: To start 1st quarter 1958.
Completion: Mid-1960.

Foreign Products Pipelines

• **Empresa Nacional de Petroleos (Government of Chile) and Cia. de Petroleos de Chile (Copec), et al.**
Project: 75 miles of 10-in. from Chile's coastal refinery at Concon to Santiago.
Status: Under way.
Contractor: **Williams Brothers**
Completion: Early 1958.

• **Mene Grande Oil Co.**
Project: 60 miles of 6-in. L.P.G. line from Anaco to Puerto La Cruz, Venezuela.
Status: Planned.
Completion: Fourth quarter 1957.

• **North Atlantic Treaty Organization**
Project: 2,000 miles of lines to airfields in parts of Europe.
Status: Under way.
Contractor: **Associated Pipeline Contractors, Inc.** (450 miles from Iskenderun, Turkey to Batman); **TECHINT** (205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir).

Foreign Natural-Gas Pipelines

• **Attock Oil Co.**
Project: 60 miles of line from Dhulian field to Rawalpindi in West Pakistan.
Status: Planned.

• **City of Riyadh, Saudi Arabia**
Project: 182 miles of 10-in. from Ghawar field to Riyadh.
Status: Planned.

• **Cuban Gas Transmission Co.**
Project: 650-mile pipeline from Campeche area of Mexico across Yucatan and on the ocean floor to Havana, Cuba; 150 miles would be submarine.
Status: Being studied by Ebasco Services.

• **Gaz de France**
Project: 550 miles of 16 to 24-in. from Lacq field, southwestern France, to Paris, plus a 10-in. lateral to Nantes and 12 to 16-in. laterals to Lyons, making a 1,000-mile system.
Status: Under way.
Contractor: French contractors.
Completion: First stage in 1958; complete system in 1960.

• **NIOGAS**
Project: 160-mile, 6, 8, 10, and 12-in. line from Fischamend field to Vienna and other Austrian cities.
Status: Under way.
Contractor: **Williams Brothers and Costain-John Brown.**
Completion: Fall 1958.

• **Petroleos Mexicanos**
Project: 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey.

• **Sui Gas Transmission Co.**
Project: 217 miles of 16-in. from Sui gas field to Moultan, Pakistan.
Status: Under way; to be extended later to Lahore with branches at Kot Addu, Jhang, Magiana, and Montgomery.
Contractors: **Pakistan Constructors,** a joint company of **Morrison-Knudsen** of Boise, Idaho, and **William Press, Ltd.,** of London.
Project: 145-mile line from Sylhet to Dacca, East Pakistan.
Status: Under consideration. If approved construction could start December 1958.

• **Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venezuela.**
Project: 207 miles of 26-in. from Anaco fields to Caracas.
Status: Under way.
Contractor: **Williams Brothers** has part.
Completion: Spring 1959.

• **Union of Soviet Socialist Republic.**
Project: 808 miles of 26-in. from Stavropol in the Northern Caucasus to Moscow, to serve Voroshilovgrad, Voronezh, Tula, Yeleta, and Serpukhov.

• **Yacimientos Petroliferos Fiscales (Argentina)**
Project: 1,015 miles of 24-in. from Camp Duran to Buenos Aires.
Status: To start 1st quarter 1958.
Contractor: **TIPSA** (Fish Engineering Corp., Fish Northwest Constructors, Inc., Clark Brothers, North American Utility, Construction International Co.).
Completion: Mid-1960.

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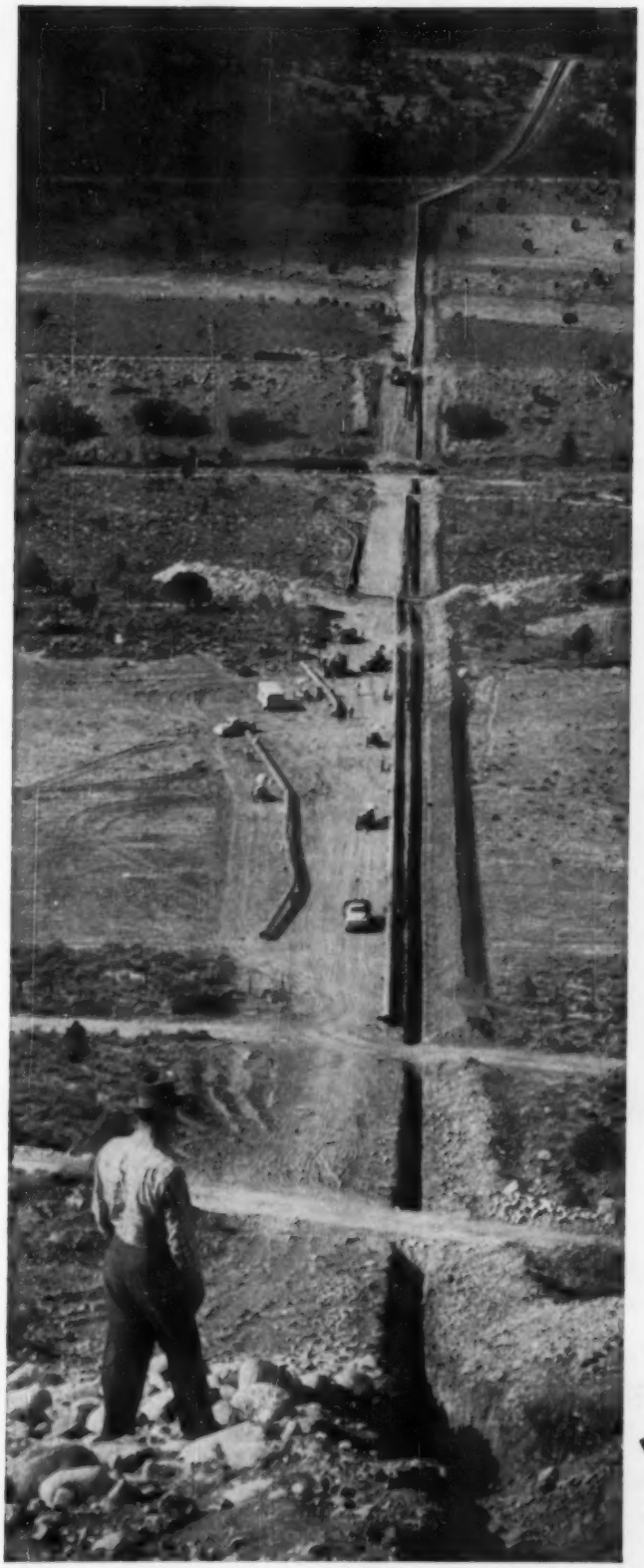

CROSS COUNTRY CHAMP!

When the going gets rough and the miles start stretching out . . . that's when you appreciate the quality of Kaiser Steel line pipe.

Here's pipe that's made for rigorous conditions. *Precision* pipe that in every length assures the kind of true uniformity that makes handling easier, installation quicker.

Kaiser Steel's fully-integrated western operation assures quality control—permitting no less than 52 tests and inspections from mine to market.

Result: in diameter, concentricity, ductility, strength . . . wherever accuracy and performance count most . . . you can count on pipe of Kaiser Steel to pay off for you in the field.

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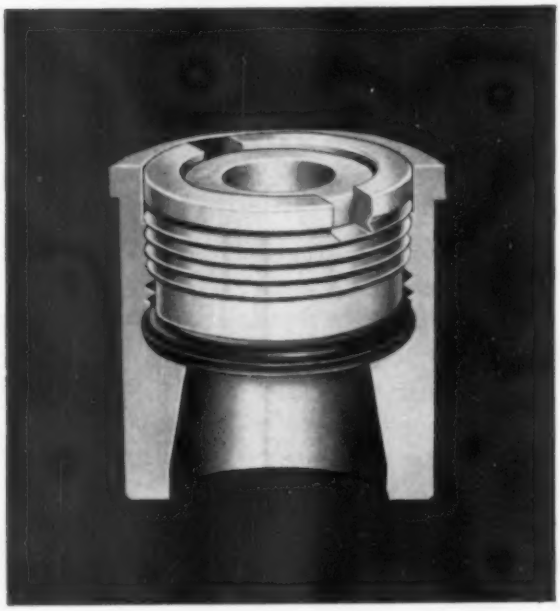
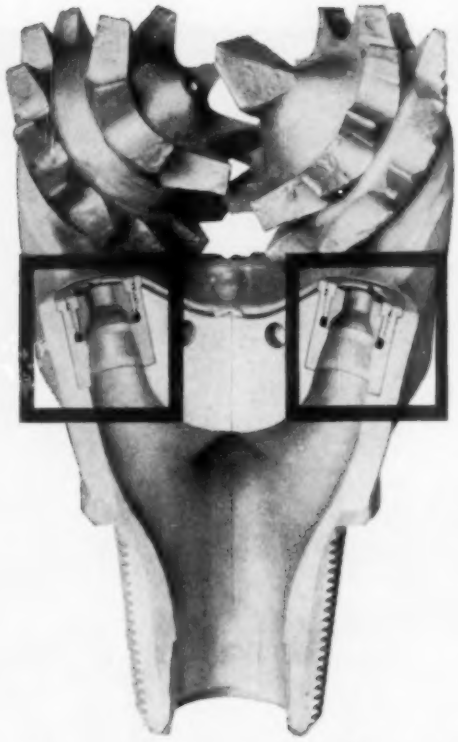
Steel Mill Products: plates • hot rolled strip and sheet • cold rolled strip and sheet • tin plate • continuous weld pipe • electric weld pipe • alloy and carbon bars • bar shapes • structural shapes semi-finished steels • pig iron • ingot molds • coke by-products • **Fabricating Division:** steel fabrication for construction, aircraft, missile and other industries • expanded fusion weld pipe reinforced concrete pipe • tanks • For specifications, write: **KAISER STEEL CORPORATION** • **Los Angeles** • **Oakland** • **Seattle** • **Portland** • **Phoenix** • **Denver** • **Tulsa** • **New York**

Another H. C. SMITH First!





Threaded Flow Nozzles in 3-Cutter Jet Rock Bits

This tested and proven new development is your best insurance against loss of nozzles.

features:

1. Easier, quicker, and completely foolproof installation of nozzles eliminates chance for human error.
2. Compressed "O"-ring acts as "shakeproof" elastic stop nut to prevent backing out of nozzle while running in the hole.
3. Fluid pressure on "O"-ring during drilling positively locks nozzle and retainer in place.
4. Unique construction eliminates possibility of excessive fluid erosion that otherwise might result in loss of nozzles.

THREADED FLOW NOZZLES ARE ONE MORE GOOD REASON WHY H. C. SMITH ROCK BITS ARE – *every bit the best*

H C Smith
OIL TOOL CO.

GENERAL OFFICES, EXPORT OFFICES AND PLANT: COMPTON, CALIF.

BRANCHES IN ALL PRINCIPAL OIL CENTERS IN THE UNITED STATES AND CANADA

Among the Drilling Contractors

Davies Joins Garvey As Contact Man in Kansas

Garvey Drilling Co.'s latest addition to its staff of contact representatives is Bert Davies, who now is working in the company's Kansas district.

Davies joined the Garvey staff last month. Previously, he had been with Welex Jet Service, working in the field out of Great Bend, Kans. He is a graduate (1948) of the University of Wichita, where he majored in business administration. After leaving school, he engaged in sales work. In his new work, he will work out of Garvey's Wichita office, reporting to Frank G. Kozak, contact manager, headquartering at the company's field office at Great Bend.

BERT DAVIES

Other Garvey contact representatives include Bill Garms, working in the Rocky Mountain district out of Denver, and Neal Colby, in the Oklahoma district out of Oklahoma City.

Barnwell Commissions Offshore Drilling Barge

Barnwell Offshore, Inc., offshore drilling affiliate of Barnwell Drilling Co., Shreveport, has accepted delivery of its first offshore drilling barge.

It was received at New Orleans where appropriate formal christening ceremonies were conducted with R. S. Barnwell, Jr., president of the company, master of ceremonies.

The barge, officially named "Mister Cap," will go into operation in the near future on its first location, in Main Pass area, off the east coast of Plaquemines Parish's Mississippi River delta.

It is the third LeTourneau-type barge to be put into service, but is the first fully diesel-electric self-contained assembly of this type. It is capable of drilling in 100 ft. of water, and to depths to 20,000 ft.

In addition to the above-mentioned president, officials of the company taking part in the dedication ceremonies included R. S. Barnwell, Sr., chairman of the board; Frank H. Harrell, executive vice president; and Morton H. Kinzler, vice president. Also participating was R. L. LeTourneau, the barge's builder.

Contracts Let for 10 Wells In Shallow Louisiana Field

Contracts for 10 more of the 40 shallow gas wells which the firm of Crowell, Nelson & Schmidt, of New Orleans, proposes to drill by the close of the year in the Lake End field, Red River Parish, North Louisiana, have been awarded Alvin Johnson, of Oil City, La., and R. P. Bufkin, of Pleasant Hill, La. Contracts are for five wells each.

The wells are being drilled to meet a contract the operating firm has to supply Petrotex Chemical Corp., of Houston, with a minimum of 5,000,000 cu. ft. of gas per day from the field. Connection of Tennessee Gas Transmission Corp.'s nearby 20-in. pipeline for delivery of the gas is expected to be completed by January 1. Ten gas wells already have been completed.

Wells average about 1,300 ft. in depth, completing in Nacatoch sand. They are being drilled on 80-acre spacing.

Claude Thompson Drilling Co. has a new wildcat operation 16 miles south of Mertzon, in Schleicher County, West Central Texas. It is under contract to Jocelyn-Varn Oil Co. for a 5,650-ft. test. Location is in Section 30, HE&WT Survey.

Simons Drilling Co. is getting well down on the 9,500-ft. test it is drilling for Cyprus Oil Co. northwest of Markham, in Matagorda County, Texas Gulf Coast. This new operation, 1 Cornelius, in the W. L. St. John Survey, is about 1¼ miles southwest of North Markham field. It is a directional drilling job.

Survey Drilling Co., Dallas, is getting under way on the first of two 8,500-ft. wildcat tests it has contracted to drill for A. R. Temple, of Biloxi, Miss., in Baldwin County, southwestern Alabama. The first test, 1 Fairhope, in 22-6s-2e, is about a mile southeast of Fairhope, in the southwestern part of the county, on the

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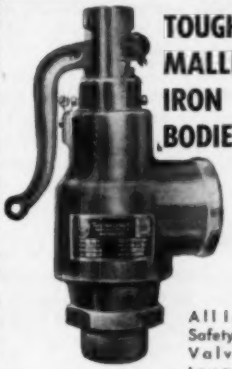
TOUGH MALLEABLE IRON BODIES



All Inferno Safety "Pop" Valves have tough malleable iron bodies. Tensile strength of material is 55,000 to 60,000 lbs. per square inch. Stainless steel stems are used. Valve seats are nickel alloy or bronze. Springs are high grade steel. You get greater safety, longer life and less blow down with Inferno.

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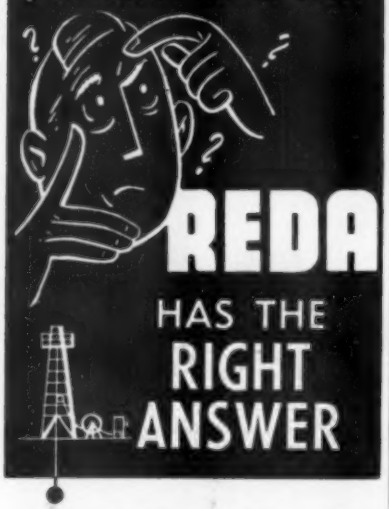
INFERNO

HOW to increase production? Lower Cost?



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east shore of Mobile Bay. The second location, to be drilled after completion of the first, is in 13-7s-6e, about a mile northeast of Lillian, in the southeastern part of the county, near Perdido Bay.

Dorris Ballew, Inc., Natchez Miss., has taken a contract job 2½ miles northwest of Jonesville, in Catahoula Parish, eastern Louisiana. It is a 5,500-ft. Wilcox test for R. A. Campbell, of Vidalia, La. Campbell's location is for 1 Davis-Sikes, in 22-8n-6e. Location is about 1¾ miles west of Patton Church field.

Jett Drilling Co., Shreveport, has a 9,250-ft. Atlantic Refining Co. contract. It will be a Tuscaloosa test off the south flank of Locust Ridge field, in Tensas Parish, northeastern Louisiana. Location is at 1-B McDonald, in 19-10n-12e. It is nearly ¾ mile from production.

Pioneer Oil & Gas Co., New Orleans, will drill a deep test about 1½ miles north of Barcelona, in Tensas Parish, northeastern Louisiana. It is a contract job for Bayview Oil Corp., of Dallas. Permit calls for a 9,100-ft. test with the Tuscaloosa as its objective. Location, at 1 Butts, in 2-10n-10e, is about a mile north of Helena field.

H & S Drilling Co., Tulsa, is drilling on a new Sunray Mid-Continent Oil Co. deep test in Bowie County, Northeast Texas. It is a Smackover contract, projected to about 10,000 ft. Location, at 1 Burgess, is nearly 2 miles southeast of Maud, in the south-central part of the county.

Pernie Bailey, Houston, is to drill a 10,000-ft. test for Cyprus Oil Co. at a wildcat location about 1¼ miles east of Phoenix Lake field, in the southwest corner of Calcasieu Parish, Southwest Louisiana. Its location is for 1 Odom, in 22-11s-13w.

Meadows & Walker Drilling Co., Houston, has taken on a directional-drilling contract in the Robinson Lake area of Chambers and Galveston counties, Texas Gulf Coast. It will be a 10,000-ft. test for Dan J. Harrison, Jr. Drilling will be deflected from a surface location on the north shore of East Galveston Bay, in Chambers County, to a bottom location about 744 ft. southeast offshore, in State Tract 177, Galveston County. Location is about a mile southwest of gas-condensate production in East Robinson Lake field. It is about 7 miles northwest across East Bay from Gilchrist, on Bolivar Peninsula.

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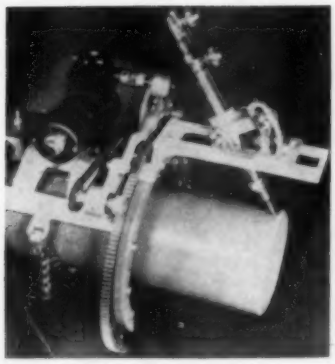
SHOWCASE...

NEW EQUIPMENT



Pipe Machine Makes Beveling Automatic

The new unit can be attached to any of seven standard H & M machines. It permits automatic beveling or cutting on pipe in sizes from 1½ to 36 in.

The motorized-unit attachment is powered by a fractional-horsepower motor affixed to the machine by a mounting bracket. Switching from manual to automatic, or vice versa, is made easy by the quickly detachable mounting bracket. A flexible coupling connects the motor to the crank pinion which drives the main gear and the cutting torch around the pipe.

Operation of the motorized unit is accomplished by: (1) setting the governor-controlled motor to the speed required to assure a smooth, clean cut, (2) lighting the cutting torch, and (3) turning the switch to the direction of travel desired. **Write or call: H & M Pipe Beveling Machine Co., 311 East Third Street, Tulsa, Okla., for details on motorized unit.**

●

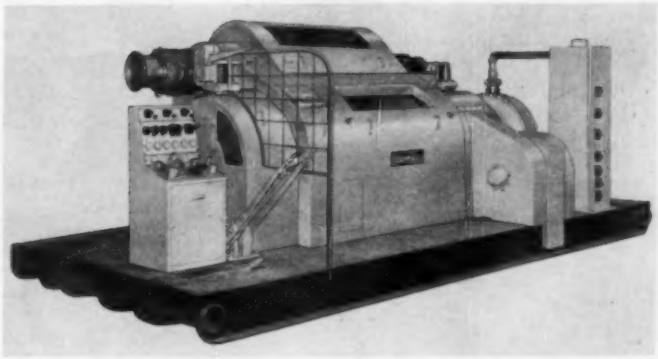
Steel Pipe Has Extruded-Plastic Coat

Called Republic X-Tru-Coat, the steel pipe is designed for use as buried pipeline in gas, oil, and petrochemical service. The polyethylene coating withstands varying conditions of corrosive soils, water, fumes, and electrochemical action, the maker reports.

According to company officials, the new plastic-coated steel pipe was developed as one answer to the problem of buried-pipeline corrosion. Production is under way in sizes from ¾ to 4½ in. in various wall thicknesses, with coatings of polyethylene in thicknesses from 0.025 in. up.

The pipe is made from selected butt-welded or electric-welded pipe. An elastic adhesive undercoating is hot applied to the pipe.

The coating allows the coated pipe to be bent or flexed without destroying the coating or causing cracks, according to the maker. Field joints can be made with regular pressure-sensitive tape and primers. **Write or call: Republic Steel Corp., 224 East 131st Street, Cleveland 8, Ohio, for details on X-Tru-Coat pipe.**



New Draw Works Rated at 1,350 Hp.

The new 860 draw works is equipped with six forward and two reverse drum speeds and three forward and one reverse rotary speed.

A choice of engines is offered on a two, three or four-engine compound. The engines may have level or step-down setting and friction clutches, magnetic or hydraulic couplings, or hydraulic torque converters.

A push-button throttle-compounding arrangement on the control panel provides for foot or hand throttle control of the engines, as required by the driller. **Write or call: Oil Well Supply**

(Continued on page 216)

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

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. . . Oil Well Servicing and Workover Units are working in most oil producing areas throughout the world. There is a right size to handle any depth well and the proper model for any field operating condition.

SKID units with their own engine suitable for barge operations or for mounting on trucks or trailers for land operation.

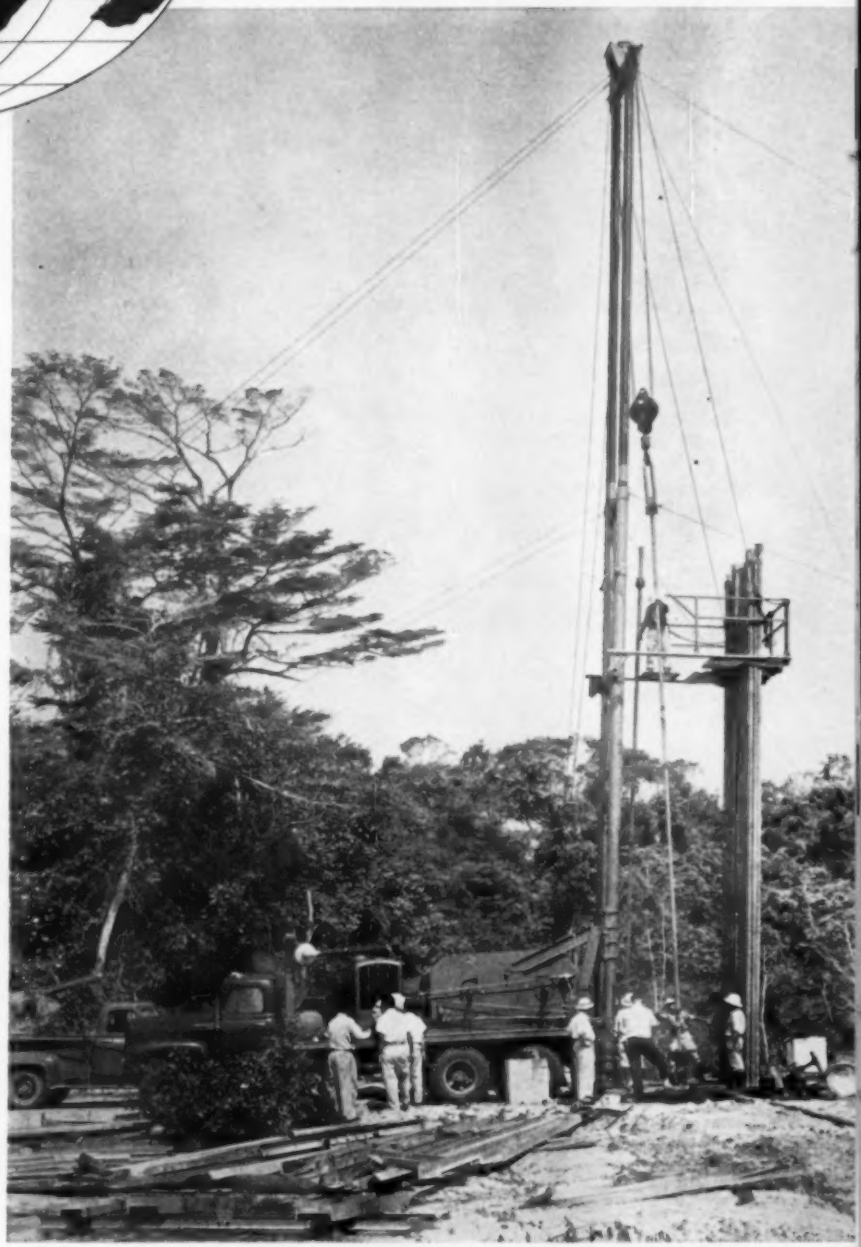
TRUCK mounted units that are powered by the truck motor.

SELF PROPELLED units for the deepest servicing or rotary workover utilizing only one engine to drive the unit over the road and to drive the winch at the well.

TRACTOR mounted units for use where terrain is exceptionally muddy or rough.

SPECIAL units where exceptionally high line pulls are required as in pulling pipe line river crossings.

All COOPER rigs are built in single drum or double drum models and can be powered by gas, gasoline or diesel motors.



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About COOPER Model T R Unit

1. Modern design, simplicity of operation and maintenance, fewer working parts.

2. Power transfer to winch through helical constant mesh oil bath gears and torque tube drive to countershaft — runs quietly, requires no adjustment, eliminates high speed chains and heavy guards.

3. Torque tube drive permits correct positioning of units on truck for proper and legal axle weight distribution.

4. Truck bed, winch, complete winch drive including power divider, quickly removable as a single unit for inexpensive remounting.

5. Choice of platform or ground controls, with the truck clutch and transmission gear shift controls conveniently located at operator's position.

6. Full air friction drum clutches are self-adjusting, smooth operating, have long lining life and each has ample capacity for maximum rated line pulls.

7. No reeving sheave required, drums positioned so lines go direct to mast crown, better spooling, less line wear and less maintenance.

8. Simplified maintenance — prelubricated, sealed bearings used where possible, grease fittings located on exterior of frame for easy access, sectional cowling quickly removable.

9. Brakes — removable rims, center anchored — dead-end equalized, self-energized, smooth and powerful holding action, positive release, one point adjustment.

10. Ample clear bed space for tools and equipment.

11. Complete accessory equipment for single and double drum models, including single or twin pole pipe mast, telescopic derrick, rotary drive, etc.

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SHOWCASE . . .

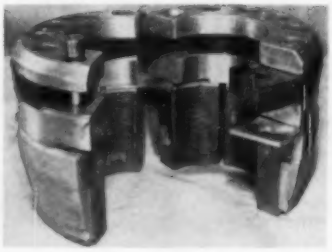
New Equipment

Div., United States Steel Corp., Box 478, Dallas 1, Tex., for details on 860 draw works.

●

Casing Hanger Handles Easily

Called the Type C-8 Automatic, the new casing hanger features a wrap-around design and two-piece construction. It supports the casing and effects a pressure seal by utilizing the casing weight, without additional bolts or set screws, the maker reports.



The hanger consists of six segments of bowl section with a slip segment to each bowl segment. Contoured steps on the external surface of the bowl segments act as load-carrying surfaces which prevent excessive reduction of the casing. Hinge straps at the joints in the hanger hold the hanger bowl and ring segments together.

The hanger is interchangeable with other hangers in its series. **Write or call: Petroleum Industry Equipment Div., Alco Products, Inc., Fourth Floor, Bank of the Southwest Building, Houston, Tex., for details on Type C-8 Automatic casing hanger.**

●

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GLASFAB® BRAND WOVEN MEMBRANE . . . for handwrapping hot lines and holidays—reliable, high tensile strength.

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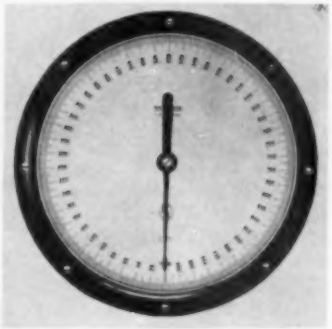


Test Gage Permits 360° Calibration

An improved technique in the manufacture of the Bourdon tube for this test gage coupled with an advanced design movement, makes possible the 360° calibration instead of the usual 270°, the maker reports. The 12-in. 360° calibrated gage provides the same readability obtained in a 16-in. 270° dial, the maker claims.

The test gage has a guaranteed production-calibration accuracy of 0.15 per cent of full scale. The gage comes in flush, wall, or stem-mounting types. Pressure ranges are from 60 to 15,000 psi. **Write or call: Martin-Decker Corp., 3431 Cherry Avenue, Long Beach, Calif., for details on test gages.**

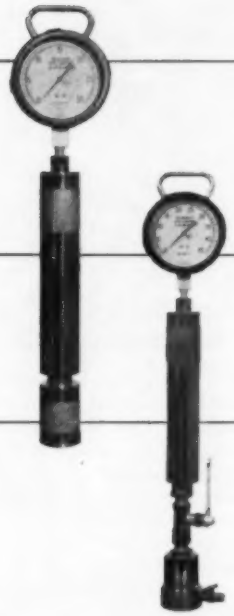
●

New Specialty Machine Fills Containers Fast

The precision filling machine is also suited for caulking compounds and specialty products, the maker reports. It's said to be practical for intermittent or short-run container filling.

As an example of its capacity, the LM-2 Filler enables one man to fill 14-oz. grease cartridges with lithium grease at the rate of 25 to 35 per minute, the maker says.

A treadle-operated air system con-



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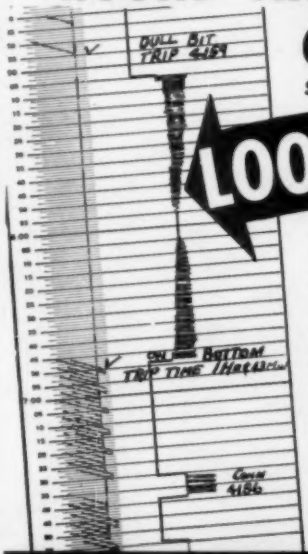

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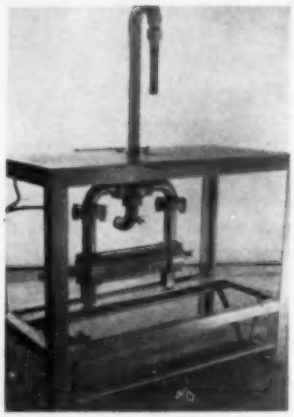
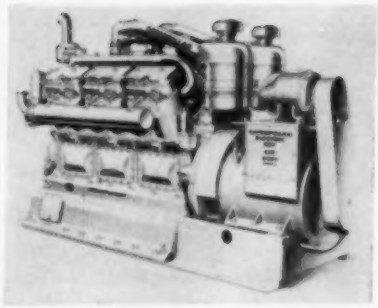
SHOWCASE . . .

New Equipment



trols the four-way valve which starts the filling cycle. Any type of pump will operate the product system. A hole in the waist-high loading table is positioned under the filling orifice to dispose of cleanout or accidental discharge. The skid-mounted unit's net weight is about 400 lb. **Write or call: Barrett Mfg. Co., P. O. Box 8096, Houston, Tex., for details on LM-Filler.**



Spark-Ignition Set Operates on Various Fuels

Here's a new electric set combining high output and compactness, the maker reports. Named the Cat D397 spark-ignition electric set, it's available with either a SRCV generator or an optional two-bearing generator. The electric set is rated at 250 kw. Power is provided by a V-type diesel engine.

The set is available with either of two engine - compression ratios — 10:1 for methane gas, or 7.5:1 for butane, propane, or field gas. It also may be converted easily for diesel operation.

Voltage is adjustable from 5 per cent above to 10 per cent below nominal voltage. Air, direct-electric, or gasoline-engine starting systems are available. **Write or call: Caterpillar Tractor Co., Peoria, Ill., for details on D397 spark-ignition electric set.**

•

New Catalyst Permits Increased Throughput

Here's a new desulfurization catalyst. It's an extruded cobalt-molybdena type called Aero HDS-2. The maker reports it reduces sulfur content of petroleum fractions by conversion to hydrogen sulfide. The catalyst is said to have good mechanical properties and especially high activity.

Extensive laboratory and field performance data show greater sulfur and nitrogen-removal efficiency than other

Drilling superintendents agree: for fast delivery you can't beat Worthington QD (Quick Detachable) sheaves — the original two-piece design. MV.7.2

WORTHINGTON CORPORATION, Oil City, Pennsylvania

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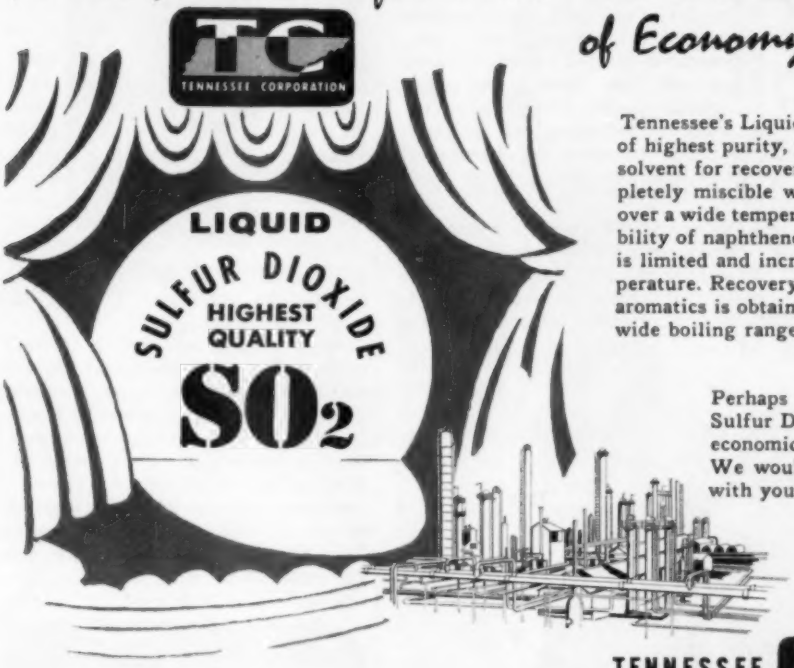

Tennessee's Liquid Sulfur Dioxide, a product of highest purity, is particularly suitable as a solvent for recovery of aromatics—It is completely miscible with aromatic hydrocarbons over a wide temperature range, while the solubility of naphthene and paraffin hydrocarbons is limited and increases with decreasing temperature. Recovery of a higher percentage of aromatics is obtained for hydrocarbons over a wide boiling range.

Perhaps Tennessee's highest purity Liquid Sulfur Dioxide can effect a more efficient and economical operation in your processing. We would like to discuss these possibilities with you.

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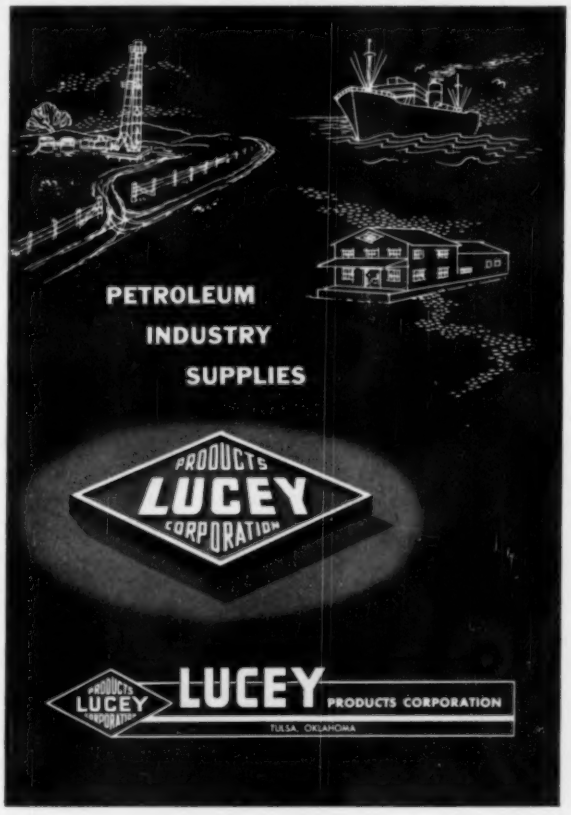


SHOWCASE . . .

New Equipment

cobalt-molybdena types, the maker reports. Higher active metals content, superior porosity, and low bulk density are also cited as significant improvements over existing catalysts.

Designed for service in both new and existing facilities, the catalyst is said to regenerate easily with little loss of activity or crush strength. **Write or call: American Cyanamid Co., Refinery Chemicals Dept., 30 Rockefeller Plaza, New York 20, N. Y., for details on Aero HDS-2 catalyst.**

Computer Automatically Gives Gas Flow

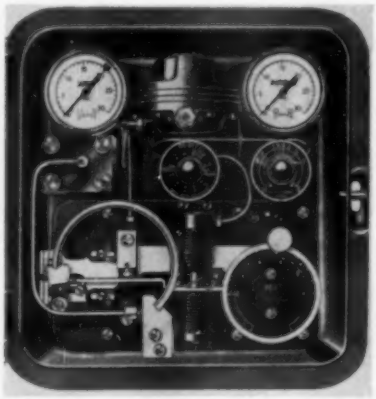
The SIE Type DRF flow computer shown here is a complete system from transducer to printed record, for computing gas flow through an orifice, the maker reports. Using the A.G.A. equation, it introduces all necessary corrections automatically. Results are visually indicated in analog or digital form.

Corrected flow from the system can by telemetered by telephone, wire line, or microwave and recorded on strip charts, log sheets, or punched cards. Both flow rate and integrated volume

are instantly available for accounting, dispatching, automatic control, and other applications.

Accuracy is 1 per cent of full scale under all operating conditions. But greater accuracy may be obtained over a limited range in environments normally encountered. The power requirement is 80 watts at 105-125 volts a.c., 50-60 c.p.s., single phase. **Write or call: Southwestern Industrial Electronics Co., P. O. Box 13058, Houston 19, Tex., for details on Type DRF flow computer.**

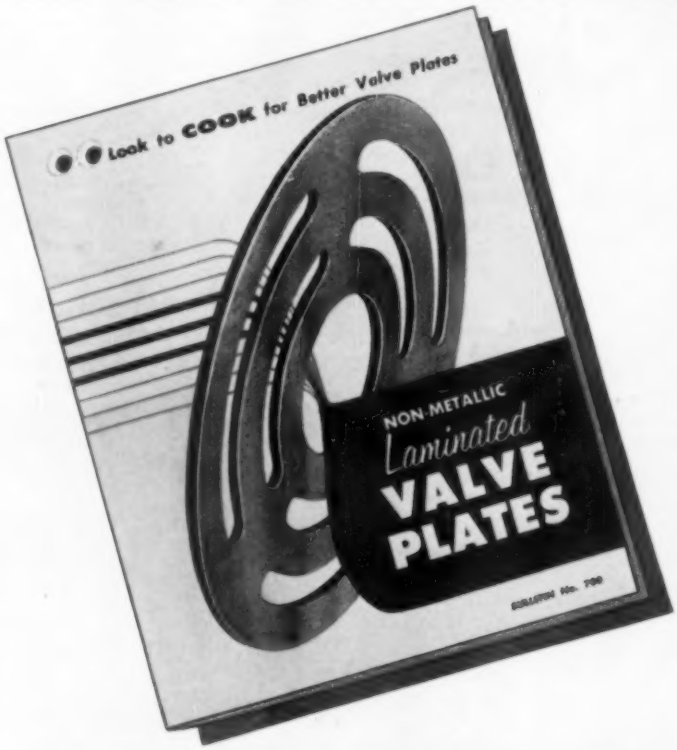
●



Pressure Controller Converted in Field

In the field, this new Wizard pressure controller can be converted easily to a: (1) two-position controller, (2) pressure transmitter, (3) controller with remote set, and (4) proportional-plus-reset controller, the maker reports. Utilizing a universal case, the controller may be remotely mounted on a wall or panel. Or it can be yoke mounted on a control valve.

Bourdon tubes may be had in bronze, alloy steel, or stainless steel in pressure ranges from 25 to 10,000 psi. The proportional band is pneumatically adjustable from 2 to 100 per cent of the Bourdon-tube range. Reset action is adjustable over a range of 0.03 to 27 minutes per repeat. **Write or call: Fisher Governor Co., Marshalltown, Iowa, for Bulletin D-4150.**



Send for this informative new bulletin today!

Cook Bulletin No. 700, *"Non-Metallic Laminated Valve Plates"* is now off the press. It contains up-to-date facts on the when, why and where of non-metallic valve plates — plus helpful data on applications, delivery and special materials. It also explains how Cook laminated valve plates are different from competitive brands, and *why* they are better.

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SHOWCASE . . .

New Literature

Rotary Washover Shoes that utilize Itcoloy tungsten sintered carbide are illustrated in a new four-page folder. Manufactured in a complete line, 10 variants or combinations of the shoes are pictured. Data on Itcoloy alloy sintered carbide as applied and the forms available are also shown. **Write or call: Bowen-Itco, P. O. Box 4587, Houston 13, Tex., for Itcoloy rotary washover shoes folder.**

●

Ductile Iron Valves are described in detail in a new six-page bulletin. The bulletin describes in specific steps the testing and research conducted by the company under the supervision of Prof. J. O. Jeffrey of Cornell University. The bulletin also describes the advantages of ductile iron. It also gives specifications on the metal as well as on ductile iron valves in actual use. **Write or call: Kennedy Valve Mfg. Co., 572 East Water Street, Elmira, N. Y., for Bulletin 572.**

●

Directions for Treating Closed Engines and Compressor Cooling Water Systems is the title of a new H-O-H Data Sheet 730. Listed are factors which influence corrosion of engine blocks, cylinder liner failure due to pitting, and impairment of cooling because of accumulations of corrosion products. Proper inhibition of corrosion required to control these factors and the characteristics essential to a good inhibitor are discussed. **Write or call: D. W. Haering & Co., Inc., P. O. Box 6037, San Antonio 14, Tex., for H-O-H Data Sheet 730.**

●

Boiler Cleaning Aid and Supplementary Treatment is described in Product Bulletin B10-85. The product is alkaline in nature and may be applied to an operating boiler. Among other features the product is said to: (1) cut cleaning time, (2) be particularly effective in dispersing calcium carbonate deposits, (3) clean headers and other areas inaccessible to manual cleaning, and (4) not require neutralizing after cleaning. **Write or call: National Aluminate Corp., 6216 West Sixty-Sixth Place, Chicago 38, Ill., for Product Bulletin B10-85.**

●

Cleaning Agents for industrial-process and heat-exchange equipment are

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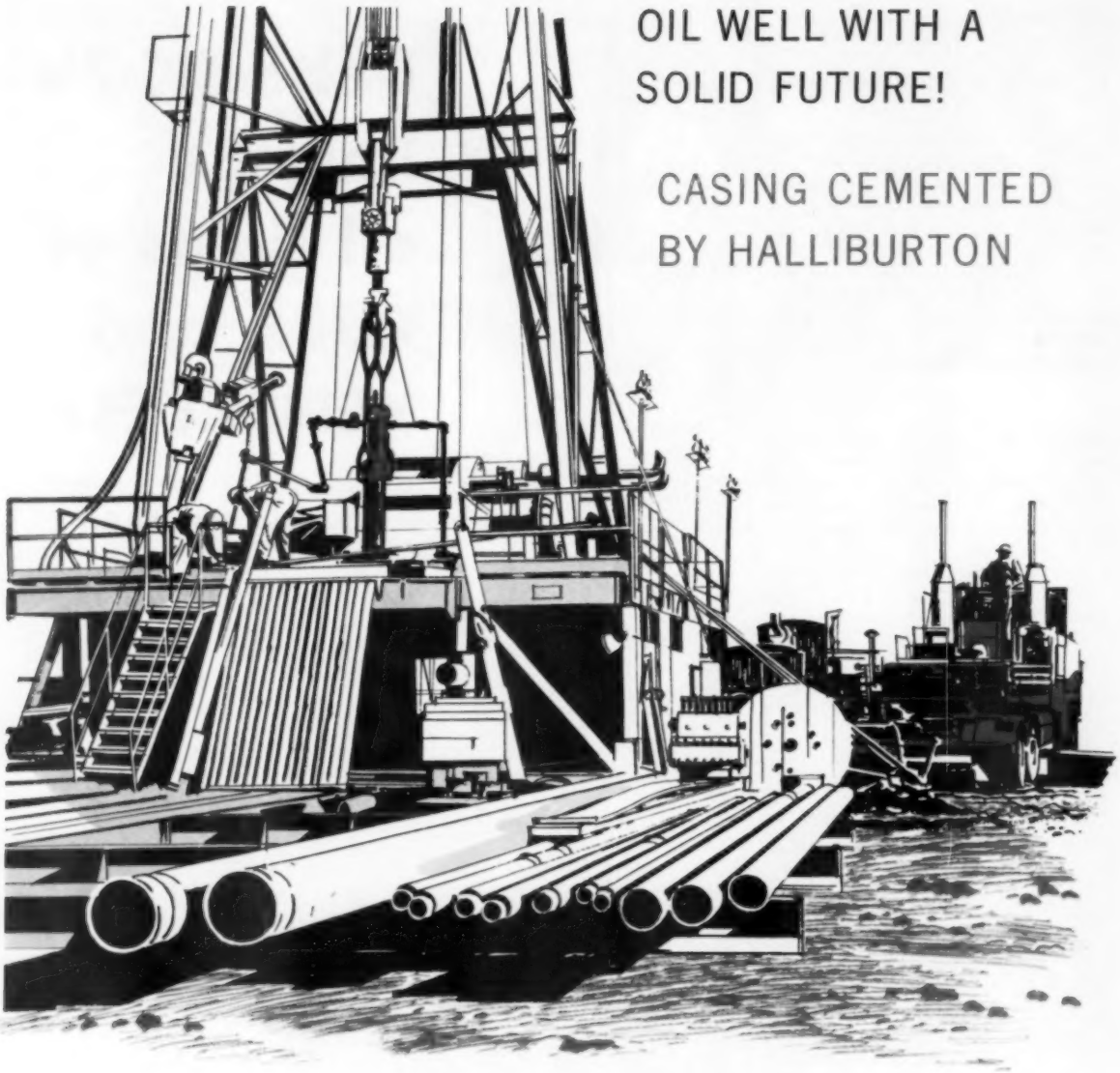
OIL WELL WITH A SOLID FUTURE!

CASING CEMENTED BY HALLIBURTON



Whenever a promising pay zone is reached, the next important step is to provide that zone with as much protection as possible . . . so that subsurface problems are kept to a minimum . . . and maximum profits result. That's why thousands of successful oilmen—ever since 1924—have called on Halliburton for oil well cementing to help protect their investments.

Halliburton cementing helps reduce the danger of casing corrosion . . . helps reduce the danger of blowout or casing collapse due to high pressures behind casing . . . helps protect promising producing zones and fresh water zones from contamination . . . and helps safeguard formations and casing strings from numerous other underground dangers.

Make sure that your well enjoys a solid future by specifying Halliburton for your next cementing job.

HALLIBURTON

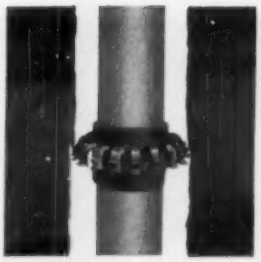
OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

TWO TYPES OF EFFECTIVE WALL CLEANERS:

New Design For Reciprocating Cleaner

HALLIBURTON NEW RECIPO WALL CLEANER...



Removes filter cake from wall of bore hole to allow better bonding of cement to formation and casing. Some of the advantages offered by the NEW Recipo Wall Cleaner are:

- Flexible, tough rubber cleaning fingers minimize bore hole or filter cake damage while running casing, yet are sufficiently rugged to thoroughly clean well when casing is reciprocated.
- Wide cleaning fingers clean broader area of bore hole wall. Aid in breaking up channeling of cement.
- Wide fluid passage areas between rubber cleaning fingers help reduce circulating pressures and bridging action of filter cake cuttings and lost circulation materials.
- Cleaning fingers do not bend into permanent distortion.
- Hinged type design permits fast, easy installation on casing.

Removes Mud Cake By Rotation Of Casing At Surface

HALLIBURTON ROTO WALL CLEANER...

Removes mud cake from walls of the hole before cementing casing, thereby minimizing precautionary or remedial squeeze jobs. Roto Wall Cleaners have these advantages:

Do not bridge off the annulus.

- Provide an open passagewey for free flow of fluids while running casing, circulating, cementing, etc.
- Reduces hazard of sticking casing off bottom because casing remains at casing point.

THESE HALLIBURTON TOOLS
help solve specific problems in oil well cementing

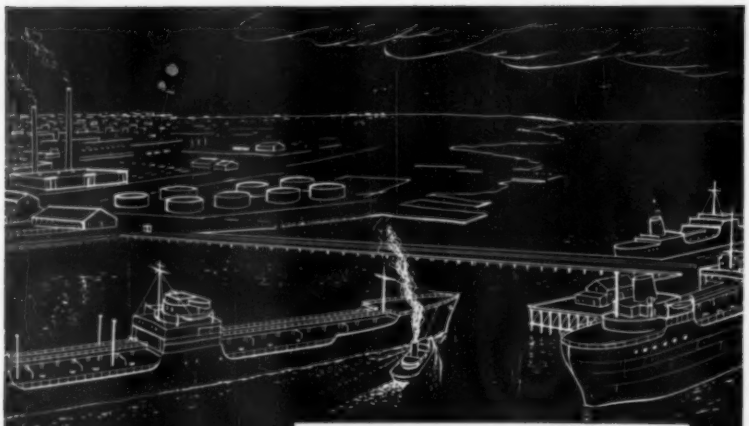
HALLIBURTON FORMATION PACKER SHOE... installed on the first joint of a string of casing offers many advantages. This shoe is used in all areas where conditions require casing to be set on top of the producing formation.

- Packer Shoe packs off open hole below casing, protecting low-pressure formations from cement contamination during cementing.
- Packer Shoe floats in and guides casing to bottom.
- Packer Shoe has a Super-Seal Back-Pressure Valve to keep cement slurry from backing up inside the casing above the Formation Packer Shoe.
- Packer Shoe provides circulation of fluids through end of Shoe until shoe packer rubber is expanded and set.

HALLIBURTON FORMATION PACKER COLLAR... installed on casing above the shoe joint to help protect a lower formation from contamination while cementing. Several joints of casing or liner may be installed on lower end of packer collar; the packer is set and cement pumped down casing and out into annulus above expanded packer. Used in setting liners, perforated pipe and screen in salt water disposal wells, water flooding projects and in fields where "Full Hole" cementing is desirable.

CEMENTING SERVICES

"A WELL WORTH CEMENTING IS WORTH CEMENTING WELL"



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NATIONAL FOAM FIRE PROTECTION SYSTEM

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covered in new Technical Data Sheets Nalclean 66 and Nalclean 68. They are blends of both organic and inorganic acids. They contain corrosion inhibitors which protect all metals commonly found in industrial equipment, according to the maker. Manufactured in a dry pulverized form, they may be conveniently handled and stored. Another feature is an indicator dye—incorporated to give visible evidence when solution strengths are depleted. **Write or call: National Aluminate Corp., 6242 West Sixty-Sixth Place, Chicago 38, Ill., for Technical Data Sheets Nalclean 66 and Nalclean 68.**

●

Plant Facilities of the Southern Pipe Coating Co. are described in an eight-page four-color brochure. The publication illustrates the firm's facilities for cleaning, coating, and wrapping pipe in all sizes from ¾ to 12 in. in its new Atlanta, Ga. plant. Drawings illustrate various stages in the wrapping process. Description is also given of the holiday detection test and other controls which assure that pipe is evenly coated and completely protected. A sketch shows the company's 17-acre yard for storage of bare and coated pipe. Described are the in-transit privileges and the company's fleet of trucks for delivery anywhere in the Southeast. **Write or call: Southern Pipe Coating Co., 795 Peachtree Street, N.E., Atlanta 8, Ga., for plant brochure.**

●

Threaded-Joint Spiral-Weld Surface Casing is detailed in a new two-page data sheet. Covering casing sizes of 16 and 20 in., the data sheet lists in tables the properties of the casing, its dimensions, and threading information. The spiral weld of the pipe extends to the threaded ends for improved strength. Threads are A.P.I. standard. According to the data sheet, slips, clamps, or elevators may be applied at any point along the casing. **Write or call: Taylor Forge & Pipe Works of Texas, Inc., 707 North Drennan, Houston, Tex., for data sheet on threaded-joint surface casing.**

●

Measuring Distance with the Tellurometer, a portable microwave instrument, is explained in a new four-page bulletin. The instrument operates in daylight or dark for base lines, traverses, and many other surveying purposes. The bulletin lists specifications and gives a number of applications for the instrument in surveying. The instrument has a maximum range of

30 to 50 miles. **Write or call: Tellurometer, Inc., 1346 Connecticut Avenue, N. W., Washington, D. C., for bulletin on Tellurometer.**

●

Diesel-Engine Performance Curves and specifications covering the Rolls-Royce line of diesels are included in new six-page Folder TSD 860. The engines are a four-stroke-cylinder type employing direct injection. They have a 5⅛-in. bore and a 6-in. stroke and come with four, six, or eight cylinders, unsupercharged, supercharged, or turbocharged. Horsepower ratings go up to 400 hp. **Write or call: Rolls-Royce, Ltd., Diesel Div., Derby, England, for Folder TSD 860.**

●

Weld Caps Folder WC-1 covers Vogt steel ellipsoidal weld caps for use in pipelines, headers, or pressure vessels. The caps come in sizes of 2 through 30 in. for use with standard-weight pipe. The folder is newly revised to cover new sizes and materials now available. It lists complete specifications and dimensions for the weld caps and available materials. **Write or call: Henry Vogt Machine Co., P. O. Box 1918, Louisville 10, Ky., for Folder WC-1.**

●

Principles of Diamond Selection in Oil-Well Drilling (Series 1001) is a new four-page publication giving a clear explanation of the two classes of diamonds. It explains their physical differences and differences in performance. It then goes into the effect of stone size for various uses of diamonds and the factors affecting proper selection of diamonds. **Write or call: American Coldset Corp., Route 46, Teterboro, N. J., for "Principles of Diamond Selection in Oil Well Drilling," Series 1001.**

●

Armored Control Tubing for pneumatic and hydraulic instrumentation is described in a new eight-page brochure. The armored control tubing is a spiral assembly consisting of several tubes. These can be installed in about the same time as a single tube. Seven types of covering for the armored tubing are illustrated and described. The tubing may consist of from 2 to 27 tubes, all within one sheath or covering. A sheath-selection chart makes it easy to select the proper sheath for various mechanical and environmental conditions. **Write or call: Okonite Co., Passaic, N. J., for brochure on armored control tubing.**

There is a distinct advantage in "divided responsibility" when this "responsibility" represents specialists in their own field of endeavor.

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TULSA . . . MEMPHIS

EQUIPMENT MEN ..... IN THE NEWS

Liberal Office Opened by Fisher Governor Co. . .

PAUL MAXWELL

to serve the western Kansas oil-producing area. Paul Maxwell has joined Sullivan - Mears Co., Fisher sales representatives in Kansas, to head this office.

Maxwell has spent 3 years in this general area in sales work. A stock of control equipment normally used in oil-field work will be maintained at Liberal.

Gardner-Denver Co. Acquired by Dresser . .

G. V. LEECE

to be combined with four present subsidiaries to form a new wholly owned subsidiary of Dresser Industries, Inc., Dallas, Tex. The acquisition is subject to approval by shareholders of both companies, according to H. N. Mallon, chairman of Dresser, and Ralph G. Gardner and G. V. Leece, chairman and president of Gardner-Denver, respectively. Leece will be chief executive officer of the new subsidiary, to be known as Gardner-Dresser Co. Its headquarters will be at Quincy, Ill.

Under the acquisition plan, shareholders of Gardner-Denver will receive one share of Dresser common stock in exchange for each share of Gardner-Denver common in a tax-free reorganization.

The new subsidiary will combine the complementary but noncompetitive lines and markets from Dresser and Gardner - Denver manufacturing divisions into a full line of machinery and equipment. The companies that will form the new unit, in addition to Gardner-Denver, are Clark Bros. Co., Olean, N. Y.; Pacific Pumps, Inc., Los Angeles; Roots-Connersville Blower Division, Connersville, Ind.; and Ideco, Inc., Dallas.

The major product lines of Gardner - Dresser will be stationary and portable compressors, reciprocating and centrifugal pumps, blowers and exhausters, pneumatic tools and oil-well drilling equipment.

Brown Oil Tool Co. Personnel Meet at Houston . .

for a briefing on the latest equipment in solving packer problems. At Brown's headquarters plant specific techniques designed for offshore wells were discussed. From left to right are J. S. Rains, Brown district manager; R. W. Donaldson, H. C. Harrison, Jr., C. A. Lamb and R. C. Grapes, all of the California Co., and P. H. Lawrence, Brown field salesman. Brown pioneered multiple parallel completions and its production facilities are geared to make special tools for special applications.

Aluminum Tubing Co. Plans Line Pipe Mill . .

in Jacksonville, Fla. According to Howard H. McCarl, general manager, the mill will manufacture welded steel, stainless steel and aluminum pipe and tubing in the 4½ to 14-in. size range.

Steel pipe will be welded by the electrical resistance welding process using equipment manufactured by McKay Machine Co. McKay is a leading manufacturer of resistance welders used in the manufacture of steel pipe. Stainless steel and aluminum pipe will be welded by the inert-gas-shielded tungsten-arc and high frequency resistance welding processes.

Steel pipe will be produced for oil and gas-gathering, transmission and distribution lines, water and oil-well casing, project water systems and construction piping.

Aluminum Tubing Co. started its manufacturing operations in Jacksonville in 1954. The company expects to be in commercial production on the new line pipe mill in March 1958.

Eastman Companies Merge

A unified and integrated organization combining the operations of 26 domestic offices with those of the foreign division is the objective of the merging of Eastman International Co. and Eastman Oil Well Survey Co.

Headquarters remain at Denver, Colo., and operations are directed through the Central, Gulf Coast, Pacific Coast and international divisions, with subsidiary companies in Canada and Germany and sales and service offices in Venezuela, Colombia, Mexico, France and other countries carrying on work of the latter division.

Eastman Oil Well Survey was organized in 1930 by H. John Eastman. European operations were reestablished after World War II and were combined with Eastman's Canadian division to form the basis of the Eastman International Co.

Superbar Mud Sales, Inc. Formed in Louisiana . .

to give complete drilling mud service. According to the president, William L. Vincent, the company is headquartered at Lake Charles, La., and has warehouses and bulk plants at Lake Charles, Jennings, and Crowley, La.

Principals and owners in the organization, in addition to Vincent, are Seth Trammell, vice president, and Charles P. Hampton, vice president.

Vincent has been active in the field of mud products and engineering for the last 15 years. Trammell has been associated with drilling-mud distribution for 17 years, and Hampton has over 8 years' drilling-mud experience.

Heading the engineering department is Guy Richards. Sales coordinator is Richard B. Carlton.

The firm will limit its service at present to Southwest Louisiana with plans for the future being expansion eastward along the Louisiana Gulf Coast.

J&L Supply Announces Personnel Changes . .

in its field sales division. According to W. L. Wolfe, vice president of sales, E. J. Pierson, formerly a resident salesman at Perryton, Tex., has been transferred to Liberal, Kans., to serve as salesman. G. N. Brotherton has been made resident salesman at Bunkie, La. He formerly was local store manager there.

S. J. Payne, salesman, has been moved from Borger, Tex., to Liberal. W. M. Wilkinson, Jr., has been promoted from storeman at Corpus Christi, Tex., to salesman at Freer, Tex. H. B. Ham has been transferred from Oklahoma City to serve as salesman at Jones & Laughlin Supply Division's Odessa, Tex., store. R. M. Sutter, salesman, has been transferred from Odessa to Oklahoma City. James M. King has been appointed salesman at Blanding, Utah. Previously he was storeman at Sterling, Colo.

Oil Well Supply Division Names Canada Appointees

W. S. PALMER

Walter S. Palmer is area merchandise manager at Calgary, and James A. Groves, field representative, has been transferred from Valleyview, Alta., to Estevan, Sask. William J. Millar has been appointed field representative at Okotoks, Alta., according to W. A. Weir, Canadian area manager of the division.

Palmer, who joined Oilwell in 1947, has served as store manager at Okotoks and Edmonton and as assistant to district manager at Edmonton. Groves served at Houston, Odessa, and Snyder, Tex., before appointment to the division's store at Swift Current, Sask. He later transferred to Drayton Valley, Alta., and to Valleyview. Millar joined Oilwell in 1956 at Okotoks.

Fritz W. Glitsch & Sons, Inc., Holds Meeting . .

in Dallas for its sales personnel. Shown in the back row are Castle Moore, New York; Howard Reynolds and Oliver Howard, Uxbridge, Ont., Canada; H. L. Wimpee, Chicago; Reg Silby, Louisville; Nat Nesbitt, Cleveland; Tom Wright, Houston; and Vernon Schiller, Dallas.

Seated in the first row are Bryan Ross, Tulsa; J. J. Tunno, New York; Jim Speckels, Houston; Lewis M. Duca, Dallas; M. C. Glitsch, vice president, Dallas; and S. G. Higginbotham, West Coast representative.

National Supply Co. Opens Store at Crane, Tex. . .

making a total of 33 stores in Texas. The store will serve oil operators in Crane County and part of Upton County. Previously this area was served from the company's stores at Odessa and McCamey, Tex.

Don L. Pummill is store manager, under the supervision of C. P. Triplitt, district manager of the Odessa district.

Carl J. Lamb Joins Higgins, Inc. . .

as engineering administrator, according to Andrew J. Higgins, Jr., president of this New Orleans shipbuilding and steel fabricating firm.

Lamb has served as an independent consulting engineer and has been with New York Shipbuilding Corp., Westinghouse Electric Corp., and Friede & Goldman, naval architects and engineers. Active as a technical writer and speaker, Lamb is the author of many articles in magazines and technical journals.

Johnston Pump Co. Makes John Mapel Sales Manager

JOHN MAPEL

According to A. H. Miller, vice president and general manager, Mapel has been with Johnston since 1948 in various sales capacities, including the last 2½ years as manager of export sales. Johnston Pump is one of the country's foremost manufacturers of deep well turbine pumps.

G & H Towing Co. Makes Safety, Longevity Awards . .

at a recent banquet in Houston. Seated left to right at the speakers' table are Capt. H. O. Weatherbee, executive vice president, Galveston; J. Newton Rayzor, board chairman, Houston; William Lawes, director, Galveston; Ed Eichel, director, Houston; and Erie D. Harlan, comptroller, Galveston.

Awards were made by company president, Cecil R. Haden. Four of the company's boats, the Trojan, Marathon, W. A. Wansley, and Lucy Haden, received safety pennants for operating a full year without a chargeable accident. According to Capt. Robert M. Brower, G & H safety and training officer, 28 masters and chief engineers were recognized for their supervision of the company's safety program among their crews.

Waukesa Motor Co. Names New Officers . .

following a directors' meeting held at the close of the annual meeting for stockholders in the company's Waukesha, Wis., headquarters.

According to James E. DeLong, president, officers heading the management group are Charles E. Nelson, Jr., executive vice president; J. Grant

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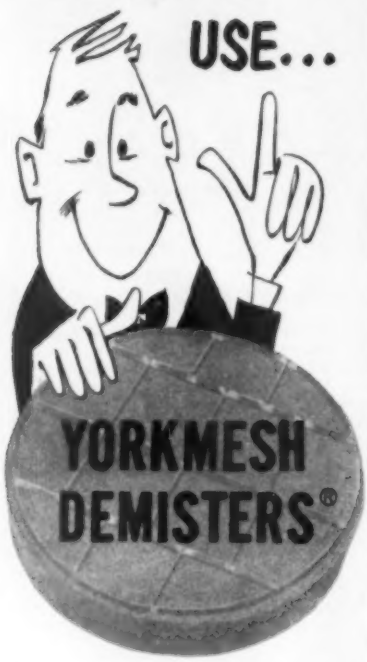

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Swain, vice president of sales; Newton H. Willis, vice president, engineering; Lewis W. Youker, secretary-treasurer; and Joseph J. Kleinbrook, assistant secretary-assistant treasurer.

Cameron Iron Works, Inc. Names J. F. Wright . .

senior engineer in charge of engineering test facilities. Before joining Cameron in 1955, Wright served with the Navy Department, Rheem Manufacturing Co. and H. Belfield Co. Until his recent appointment he had been in charge of field-testing Cameron's valve products.

Standco Brake Lining Co. Patents Hard-Hole Process

This feature in its woven brake lining has apparently solved a maintenance problem troubling drilling crews for many years.

According to C. W. Hanslip, founder of the company, and pioneer in oil industry brake-lining design and development, the patented process, a development of the Standco research department, has been incorporated in the regular Standco brake lining for 2 years. Announcement was withheld pending proof that the process would eliminate the problem of brake blocks pulling loose from the bolts in rugged oil-field service.

The Standco block features a hardened area immediately around the bolt hole and under the bolt head, which never comes in contact with the brake drum, but which reinforces the area of the block which was previously crushed if bolts were pulled too tight, or which might tear if bolts began to loosen in service.

Thomas E. Turner Named to Leschen Sales Post . .

by H. K. Porter Co., Inc. Turner will be sales representative for Virginia, West Virginia and North Carolina.

Prior to this appointment he was a sales representative for Esso Standard Oil Co., covering the State of Virginia.

Miller V. Sparks Named by Mission Manufacturing Co.

M. V. SPARKS

He has been appointed director of public relations, a newly created position, according to Richard E. White, executive vice president and general manager.

Prior to joining Mission, Sparks was with Edwards Drilling Co. He served Mission as purchasing agent until 1942. Sparks was sales manager of the newly formed centrifugal pump division prior to his present assignment.

W. J. Nutto Joins "driltrol" Corp. . .

as Louisiana Gulf Coast agent. He has had 20 years of industry experience, including service as sales manager of both Reed Roller Bit Co. and Hunt Tool Co. His work has also included service as salesman and export manager. Assisting Nutto in charge of field service will be Frank Cox, directional drilling service man in the Louisiana Gulf Coast region for the past 5 years.

"driltrol" also announced the establishment of a new office and completely stocked 1,800-sq.-ft. warehouse in Lafayette, La. Other service points are planned throughout the area.

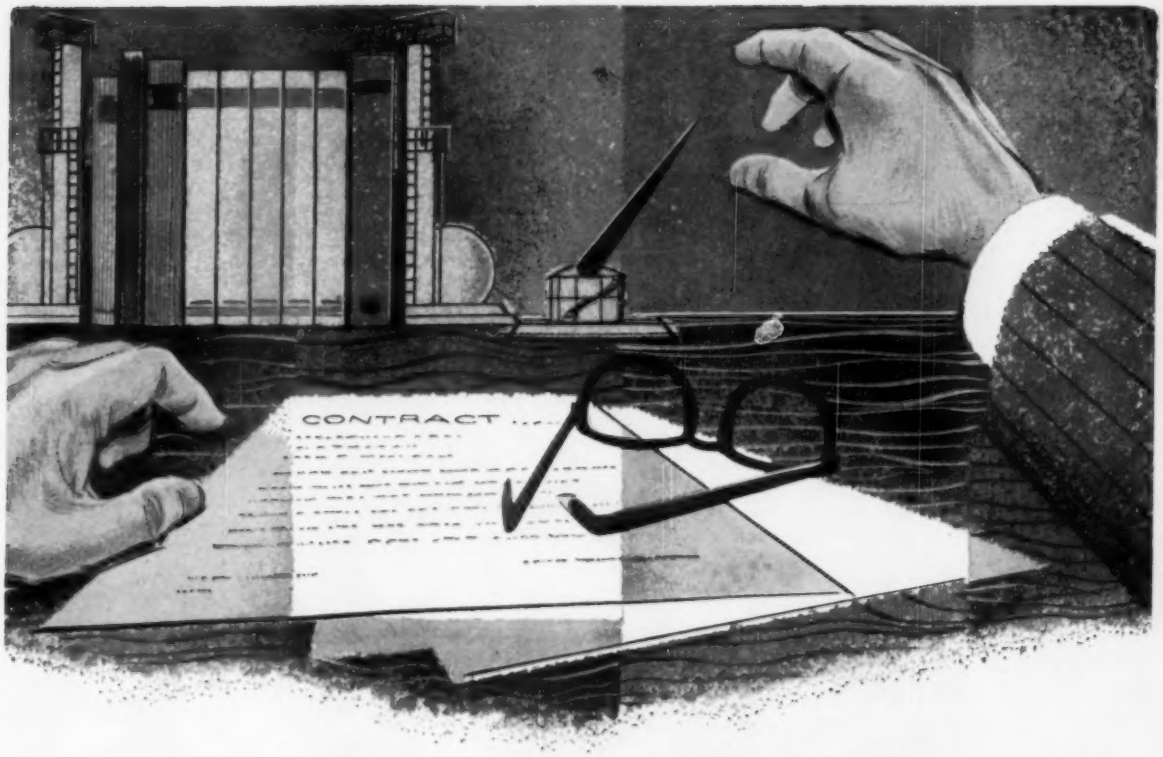
The "driltrol" product is a drillable wing stabilizer with hard-faced aluminum alloy wings, said to be washed over in a matter of minutes.

Blaw-Knox Appoints Robert E. Walsh . .

R. E. WALSH

regional vice president in the Chicago area. The new position was established, according to W. Cordes Snyder, Jr., president, to consolidate responsibility in the area served by the company's three Chicago sales offices. Sales activities in the Chicago region are supported by a district sales office, by the Chicago office of the company's chemical plants division, and by an office responsible for roll sales, western casting sales and armor sales.

Walsh will continue to supervise roll sales activities in the Chicago



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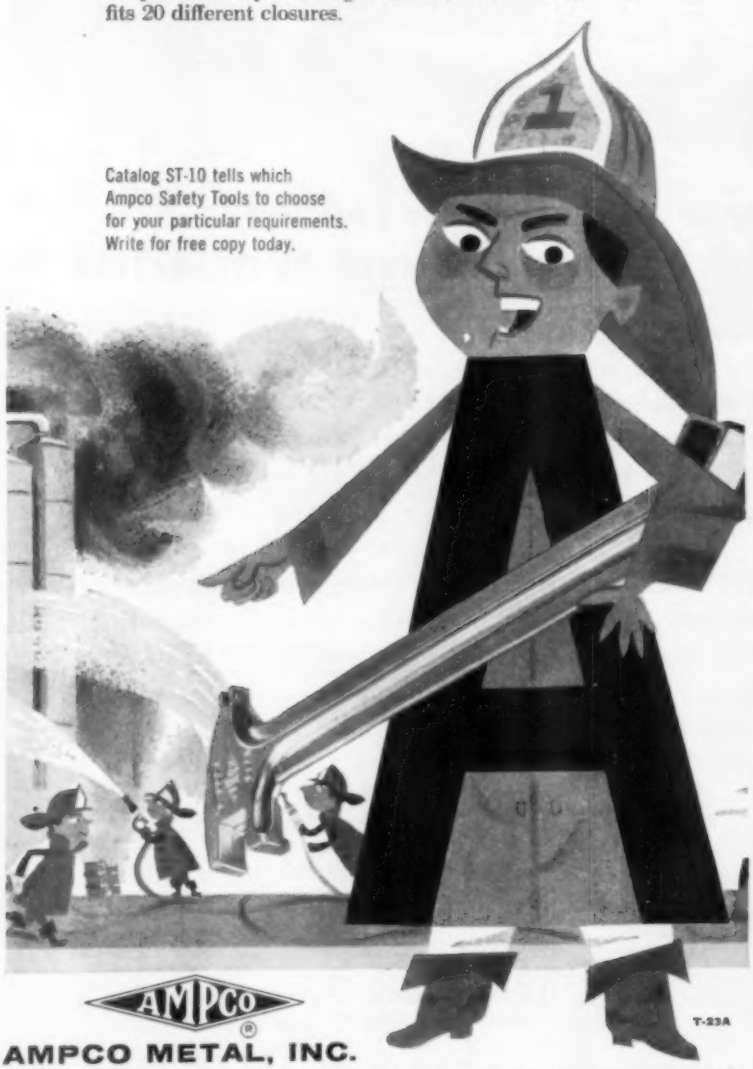

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area, a position he held prior to his new appointment. He will have offices at the company's East Chicago, Ind., Works, as well as an auxiliary office in the Chicago district sales office.

Well Completions, Inc., Names Don E. Stewart . .

manager of the firm's engineering department, according to Gordon Jackson, president.

Prior to joining the Denver firm, Stewart was for 10 years with Pan American Petroleum Corp. in its Tulsa research center. Stewart specialized in conducting both laboratory and field tests in the rapidly developing field of air drilling.

McCullough Tool Co. Names Newton H. Ottinger . .

N. H. OTTINGER

sales manager for its Four Corners district. According to I. J. McCullough, president, Ottinger will headquarter in Farmington, N. M., and will supervise sales in the portions of New Mexico, Arizona, Colorado and Utah which comprise the Four Corners district.

Prior to joining McCullough in 1955, Ottinger was with Sinclair Oil & Gas Co. and prior to that was with Schlumberger Well Surveying Corp. 16 years.

L. B. Foster Co. Adds Paul E. Richard . .

to the sales staff of the Los Angeles office. He will specialize in tubular products sales. Richard was formerly with Republic Supply of California where he handled pipe and tubular products sales to the petroleum industry.

Aero Design & Engineering Co. Elects Officers . .

following the annual stockholders' meeting. The officers include George T. Pew, chairman of the board and president; Budd Parks, vice president and secretary-treasurer; T. R. Smith, vice president, engineering, research and development; R. J. White, vice president, director of sales; Jack Laister, vice president, operations; H. S. Newman, vice president, industrial relations; and Eugene Burke, controller.

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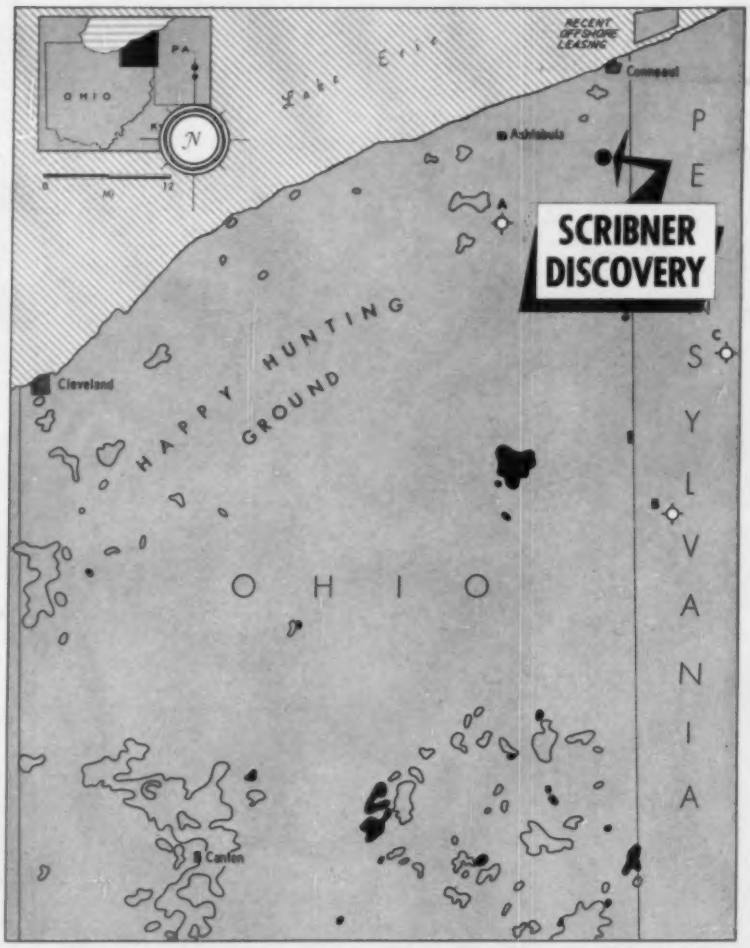
EXPLORATION

Ohio Strike Underscores Appalachian Neglect

By Frank J. Gardner

OVER THE PAST few years, many independent oil men have become intrigued with the idea that the Appalachian basin states still hide a lot of undiscovered oil and gas pools. The belief is based not only on the feeling that many prospects were simply trampled underfoot in the early-day drilling rush, but also on a surging belief in the stratigraphic trap and on the success of newer drilling and completion techniques that have appeared since 1950.

In Ohio, for instance, while the actual number of wildcats drilled has declined a little since 1954, the success percentage has steadily climbed to a whopping 41 per cent.



A RECENT FLUSH LOWER SILURIAN oil discovery by Benedum-Trees in northeastern Ohio accents the great hidden potential of the Appalachian basin. Closest Silurian oil production is 86 miles west-southwest at Medina.

A case in point . . . Nowhere has this been better illustrated than at the recent highly publicized strike of Benedum-Trees Oil Co. at its 1 Scribner in Ashtabula County, Ohio (Section 26, Monroe Township). This discovery, now officially finished for a flow of 151 bbl. of 39°-gravity oil daily on a ⅝-in. choke, was the result of long and patient study of the geologic history of the northwestern Appalachian shelf. The operators credit the success entirely to subsurface geology.

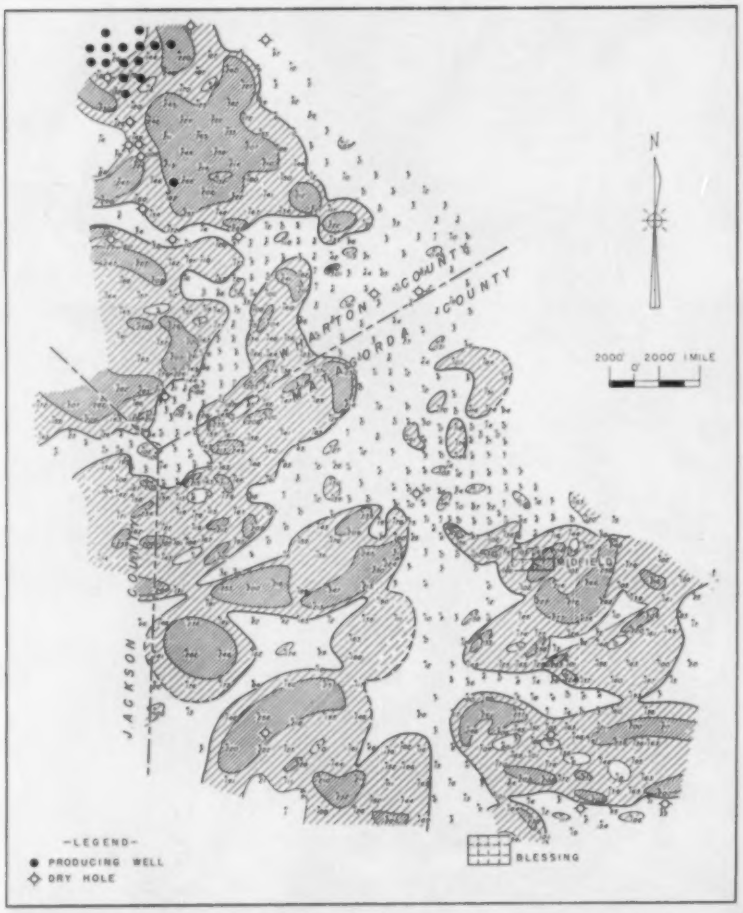
Benedum-Trees drilled four dry holes on the shelf before the discovery; none was in the immediate area of the strike, but each contributed new knowledge of shelf subsurface geology. At A (on map), the company drilled a 6,189-ft. Cambro-Ordovician hole in Jefferson Township, Ohio; at B, in Mercer County, Pennsylvania, 35 miles southeast of the Scribner, another Cambro-Ordovician test went to 8,210 ft.; at C, a 4,400-ft. Silurian wildcat in Crawford County, Pennsylvania, was 22 miles southeast of the Scribner; and a fourth test, not on the map, was located in Erie County, Pennsylvania, 35 miles east of the discovery, and tested Lower Silurian to 3,600 ft.

Credit for this discovery must go to an earnest young geologist named Earl Linn. He has tried for several years to call industry attention to the hidden potential of the Appalachian basin (OGJ, April 30, 1956, pp. 165-173). He has stressed the importance of stratigraphic entrapment in the basin. "Ninety per cent of this production," he points out, "has been found in stratigraphic traps."

Clinches a case . . . The Scribner discovery is one more clincher for Linn's case. He believes the new well is producing from a Medina-Lower Silurian reef, and that many more such reefs are to be found on the northwestern shelf of the basin. On surface elevation of 912 ft., the Scribner topped Lower Devonian at 1,922 ft., Upper Silurian at 2,280, Middle Silurian at 2,852, Lower Silurian at 3,132, and Upper Ordovician at 3,417 ft. Operators carried the hole to 3,440 ft. and plugged back to 3,370 ft. for hydrafrac completion through perforations at 3,292-3,340 ft. It was a cable-tool operation drilled in 6 weeks at a cost of $4.50 per foot.

And testifies to neglect . . . Here again is testimony to neglect. This northwestern Appalachian shelf has not been adquately tested for Silurian and Cambro - Ordovician production. The well density to or through the Silurian in northeastern Ohio and northwestern Pennsylvania is only one well to 36 sq. miles; of the wells that have been drilled, more than half have reported oil and gas shows in Lower Silurian; three-fourths of these were drilled 20 years or more ago.

"Needless to say," says Linn, "I think the area has very good possibilities." Doesn't this elegant understatement rouse your oil-finding instincts?



ETHANE and heavier hydrocarbon data obtained in 1944-45 over an area in the Texas Gulf Coast. A number of well-defined anomalies are readily recognized. Well symbols show development at the time data were acquired. Fig. 1.

How Geochemical Analysis Helps the Geologist Find Oil

By Leo Horvitz

EXPLORATORY methods that fall in the category of geochemical prospecting are those that involve the use of chemical techniques. In one such method, liquid and waxy materials,[1,2] extracted from the top soil with organic solvents, are used as petroleum indicators. Another method is based on the determination, in deeper samples, of acid and water-soluble inorganic[2] salts. Others involve the determination of a fluorescent material,[3] carbonates,[4] reduced iron,[4] and unidentified substances.[5]

Actually, there are as many geochemical methods as there are constituents of the soil. And yet, all of these techniques have one fundamental requirement in common: The lighter of the hydrocarbons which make up gas and oil accumulations migrate from the deposit to the surface of the earth.

The waxy and liquid materials may be formed through oxidation and subsequent polymerization of these hydrocarbons. The accumulation of inorganic constituents in the immediate subsurface also may be associated with hydrocarbon migration. The presence near the surface of volatile hydrocarbons, themselves, and their suggested relationship to petroleum accumulation at depth are phenomena that are considered of much greater interest and significance.

Oil and gas deposits . . . Early attempts to relate near-surface hydrocarbons to oil and gas deposits were made in 1929 in Germany[6] and, in 1932, in Russia.[7] Investigators of these countries found the soil air over oil and gas accumulations to be enriched in hydrocarbons.

The author says . . .

1. All geochemical methods of prospecting for oil and gas require that the lighter of the hydrocarbons that make up the sought deposit migrate vertically to the surface of the earth.

2. The data presented show a close relationship between near-surface hydrocarbons, especially those heavier than methane, and the buried oil field. In general, the better oil fields produce halo type of anomalies; in these, relatively high hydrocarbon concentrations border an area of low or intermediate values. Surrounding this type of anomaly is an area of low background values. Another pattern that has been recognized is one in which an area of uniformly high concentrations is surrounded by relatively low background values. For the case of all types, the hydrocarbon anomaly is usually larger in areal extent than the deposit that produces it.

3. Experiments indicate that methane may be produced from organic matter but the presence, in near-surface soils, of appreciable amounts of ethane and heavier hydrocarbons cannot be explained away in this way. The data presented suggest subsurface petroleum deposits as a logical source.

4. From the hydrocarbon-distribution pattern, it is not possible to predict the depth to a deposit, nor the type of trap which contains it. Anomalies produced by petroleum contained in stratigraphic traps are similar to those produced by deposits associated with structure.

5. The data presented represent only a small part of the experience which suggests that the chance of finding a petroleum accumulation under a hydrocarbon anomaly is good, while the chance of finding an accumulation in the background, or negative, area is poor.

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Americans[18] became interested in this new approach to petroleum prospecting in 1936. Instead of collecting samples of the soil air in the field, samples of the soil itself, were collected and analyzed. Not only were much larger quantities of petroleum gases found than those reported by earlier investigators, but heavier, saturated hydrocarbons also were detected. Using this technique, samples may be collected under practically all conditions.

Important producing fields such as Hastings,[19] Friendswood,[1] and Heidelberg were sampled to determine if a relationship exists between near-surface hydrocarbons and petroleum accumulation at depth.

The hydrocarbon-distribution patterns seen in these cases contain low hydrocarbon values over the central portions of the anomalies with relatively high concentrations at the edges, and low values again in the background areas—a pattern frequently referred to as a halo. Because anomalies of this type alone were at first considered significant, errors in interpretation occurred.

After a great deal of data were accumulated, it became apparent that commercial oil accumulation may be associated with anomalies composed entirely of intermediate and high values which are surrounded by low, background values. However, even this type of anomaly, which suggests migration to the surface from the entire deposit, frequently contains the highest values at the edges. This indicates maximum leakage.

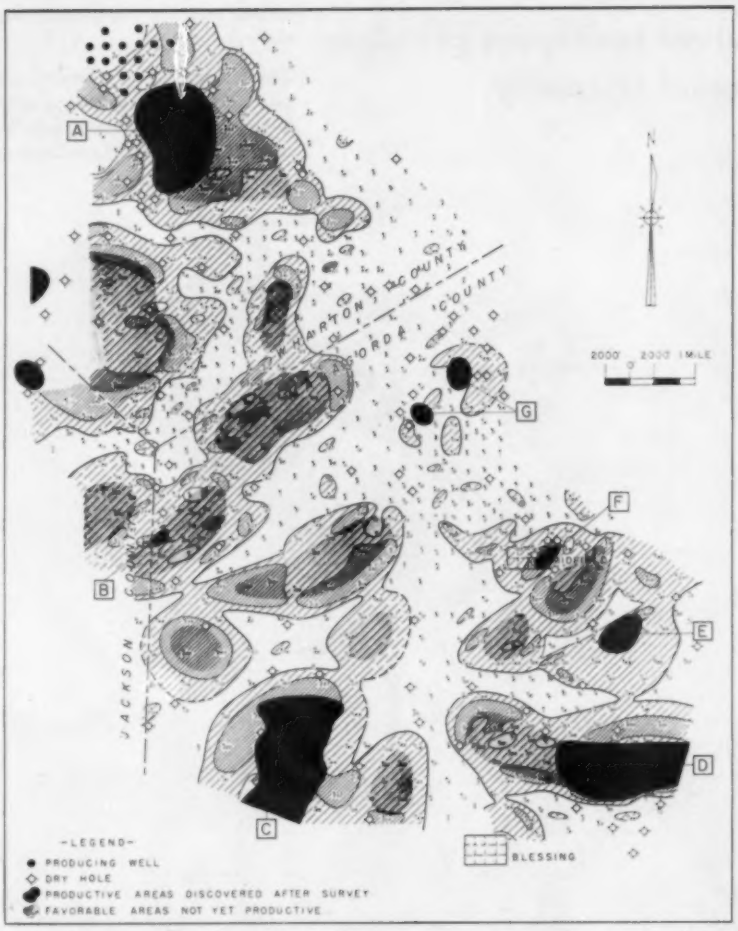
Types of anomalies . . . Several different hydrocarbon-distribution patterns appear in Fig. 1, a portion of a large survey conducted in parts of Wharton, Matagorda, and Jackson counties, Texas in April 1945. The map includes 748 stations which were sampled at a depth of 10 ft. over an area of 50,000 acres. Values shown on the map at the respective station locations are for ethane and heavier hydrocarbons expressed in parts per billion by weight. In this figure only the development at the time the data were obtained is shown. To simplify the presentation of the data, only the contour lines enclosing values ranging from 100 to 199 and values of 200 p.p.b. and above are included.

The present map is very similar to the original in spite of the fact that contours enclosing values below 100 p.p.b. are omitted. Even so, the background averages less than 25 p.p.b., the normal range for most of the Gulf Coast.

To display the variations in hydrocarbon concentrations over the area sampled, those areas containing values above 100 p.p.b. have been shaded. The lightly shaded areas contain values from 100 to 199 while the more heavily shaded areas include values of 200 and above. Values below 100 p.p.b. are in the unshaded areas.

Only halo type of anomalies, the centers of which contain values of the same low order of magnitude as those of the background, were first considered of importance. As a result, the first interpretation of the data presented in Fig. 1 suggested, as favorable, the elongate area of low concentrations which centers to the northeast of the intersection of the three counties. The failure of a test well which was drilled within this area, followed by the development of South Hilje oil field which is associated with the area of high concentrations in the northwest part of the survey, attracted attention to the non-halo type of anomaly.

The discovery of Midfield and



SAME AREA AS SHOWN IN FIG. 1 plus results of drilling to August 1956. Oil fields, discovered after completion of the survey, fall within anomalous areas. Numerous dry holes were drilled in the background or negative area. A number of anomalies have not yet been tested. Fig. 2.

THE AUTHOR

Dr. Leo Horvitz is owner of Horvitz Research Laboratories, Houston, Tex. He holds B.S. and M.S. degrees from Brown University and a Ph.D. in chemistry from the University of Chicago. From 1936 to 1941 he was chief research chemist and geochemist for Subterrex. During 1942-43 he was a group leader on a war-research project at the University of Chicago after which he resumed his work on the development of geochemical exploration methods in his own organization. Dr. Horvitz is a member of Sigma XI, the American Chemical Society, the American Association of Petroleum Geologists, the Society of Exploration Geophysicists, and the American Institute of Mining, Metallurgical, and Petroleum Engineers. This article was first presented at the twentieth International Geological Congress in Mexico City, 1956.

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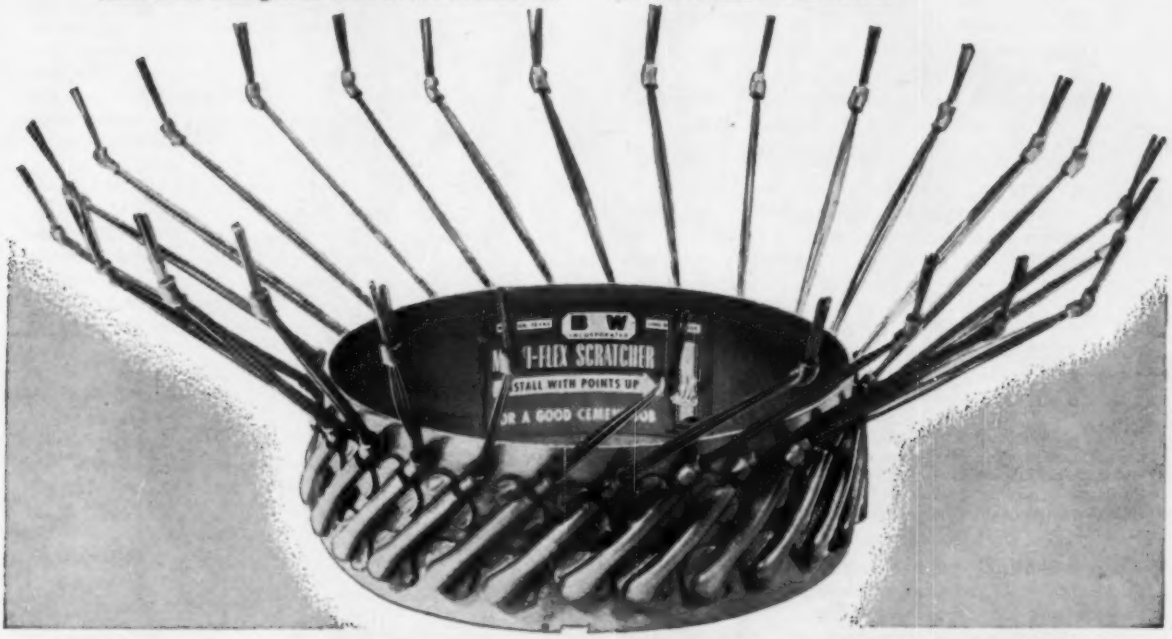

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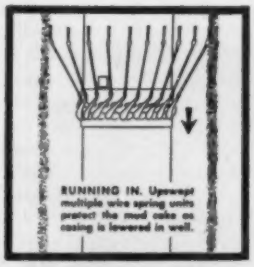

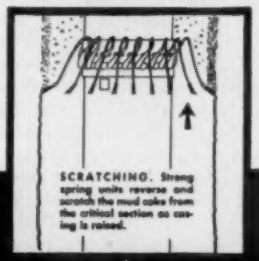

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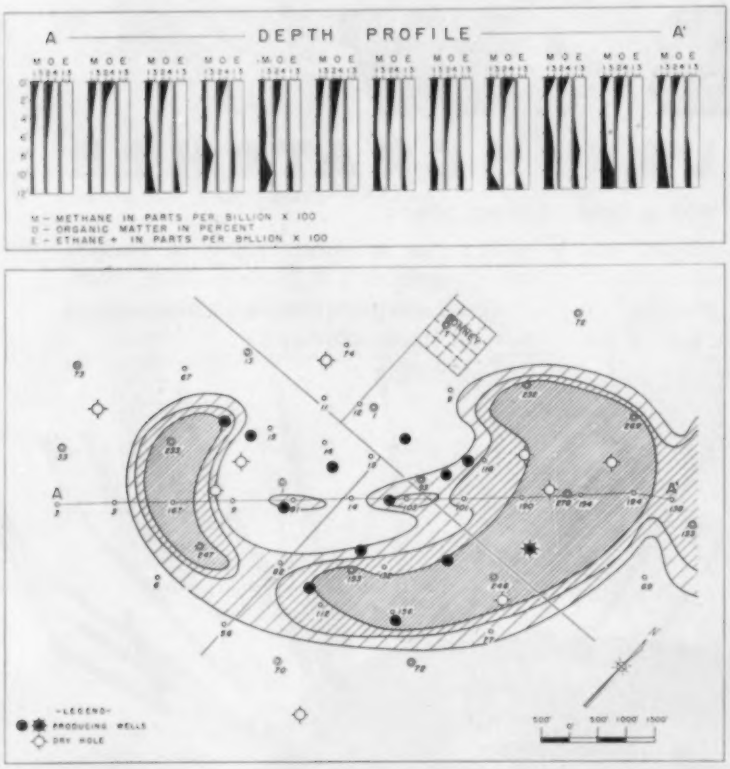
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RELATIONSHIP of hydrocarbons to organic matter is shown at top. Methane follows organic matter near surface but below 6 ft. it follows ethane and heavier hydrocarbons which do not appear until edge of oil field is approached. Lower portion of figure shows locations of profile stations in relationship to the hydrocarbon anomaly over Bonney field, Brazoria County, Texas. Only data for deepest samples are included. Fig. 3.

only a few are comparable with these: the remainder are of small areal extent.

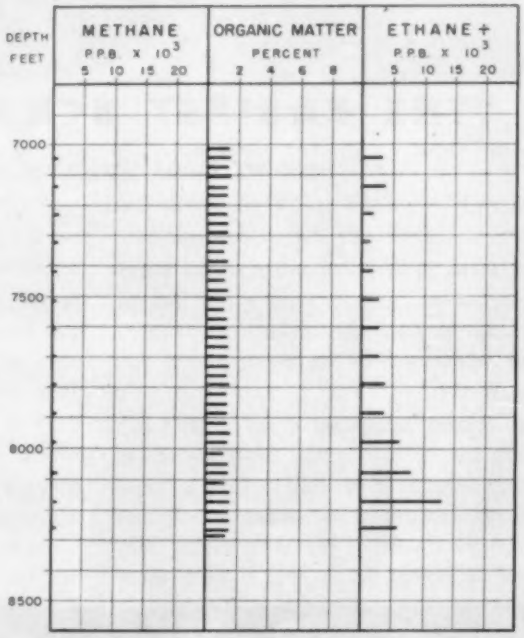
Brazoria County results . . . In the lower part of Fig. 3 the ethane and heavier hydrocarbon data are shown. These are expressed in parts per billion by weight. They were obtained near Bonney oil field of Brazoria County, Texas, from samples collected at 9 to 12 ft. The following groups of values are enclosed by the various contour lines: 75-99; 100-149; and 150 and above. Several degrees of shading have been used to display the variations in hydrocarbon concentration; the heavier the shading, the higher the range of values. This area was selected as prospective on the basis of a reconnaissance survey completed in 1948, several years prior to the discovery of the field.

More recently, during 1955, additional experimental work was made in this area in connection with a study of the relationship of hydrocarbons to organic matter in near-surface soils. Stations sampled in the early survey are indicated on the map by double circles. Recently, samples were collected along profile A-A', at the locations indicated, from the surface and at 2-ft. intervals down to and including 12 ft. The samples were analyzed for methane, ethane, and heavier hydrocarbons, sand content, and organic matter. A number of Tidehaven fields, to the northwest and northeast of the town of Blessing, respectively, confirmed the importance of this type of anomaly. Because most of the area included in the survey was barren of production when sampling was completed, the possibility that the hydrocarbons are present in the soil through contamination by producing wells is eliminated.

Fig. 2 shows the development that has taken place in the area to August 1956. In addition to the fields previously mentioned—South Hilje (A), Midfield (C), and Tidehaven (D)—more recent confirmations of the data resulted by discovery of Denman (B), North Tidehaven (E), Midfield Townsite (F) and Arch (G) fields. Arch field is the only one associated with an anomaly suggesting the halo type.

In addition to the anomalies which are now associated with petroleum, a number of others, also believed to be produced by subsurface hydrocarbon deposits, are apparent. The most favorable portions of these have been shaded in gray. Only one anomaly has been condemned by the drill. In those parts of the survey where a reconnaissance sampling density was used, the interpretation may be changed by additional data.

Negative areas . . . At least 45 dry wildcat wells were drilled in the background, or negative, areas. Thirty-five of these dry holes were drilled after the data were obtained. Even some of the dry holes that fall within the anomalous areas, but close to their edges, could have been eliminated on the basis of the data. Thus far, all of the fields that are producing in the area sampled, especially the more important ones such as South Hilje (A), Midfield (C), and Tidehaven (D), are associated with well-defined anomalies of high contrast. Of the untested anomalies,



WELL CUTTINGS yield uniform values for organic matter while ethane and heavier hydrocarbons show distinct increase with depth. A commercial oil deposit, encountered within section which produced highest ethane and heavier hydrocarbon value, suggests source of buildup. Fig. 4.

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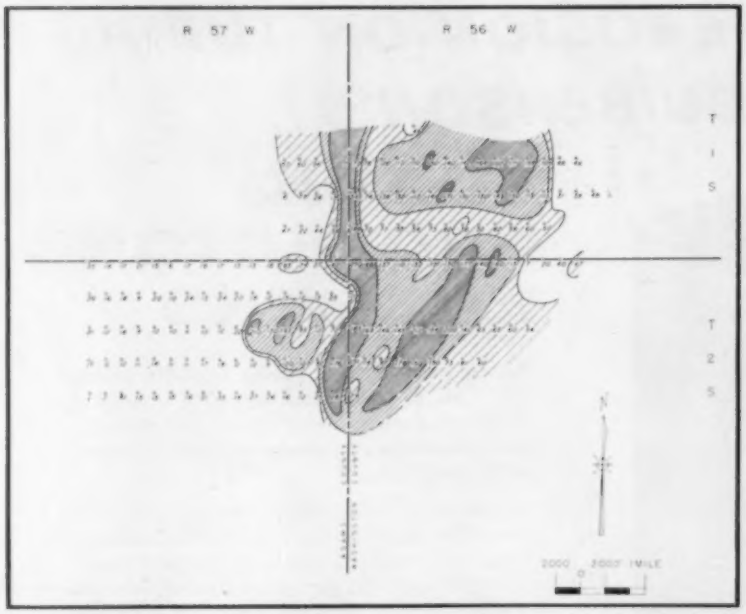
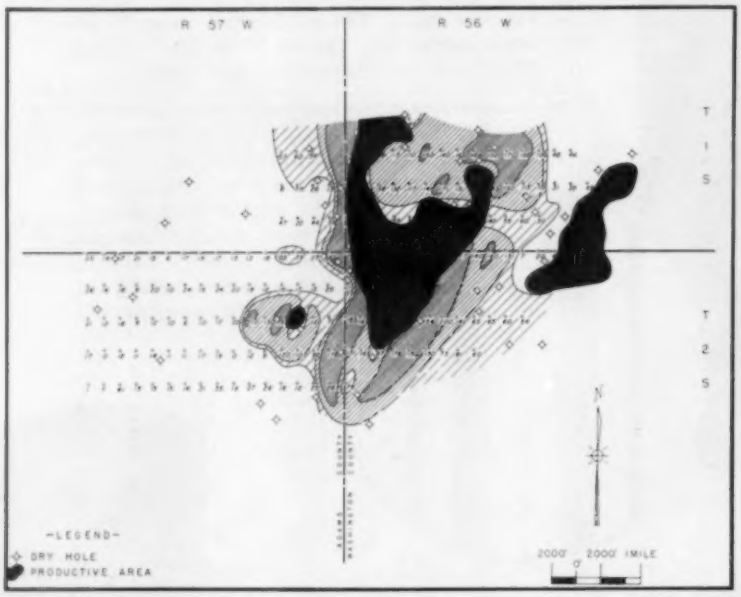


ETHANE and heavier hydrocarbon data in the vicinity of Little Beaver oil field, Denver basin, Colorado. Strong anomalous area which resembles those of other petroleum provinces is recognized easily. Fig. 5.



SAME AREA AS SHOWN IN FIG. 5 plus the development to August 1956. Configuration of the hydrocarbon anomaly is similar to that of Little Beaver field. Small anomaly to the southwest of main feature is associated with a minor producing area. Hydrocarbon data were acquired after discovery of Little Beaver but before discovery of field to east. Fig. 6.

other samples were taken over the area at approximately 12 ft. to complete the hydrocarbon survey.

In the upper part of Fig. 3, data for each of the samples taken along the profile are shown in graphic form. For the case of methane (M), and ethane and heavier hydrocarbons (E), each unit on the horizontal scale represents 100 p.p.b. by weight. The distribution patterns for organic matter (O), expressed in per cent, are all alike. For each station, the largest quantity occurs in the top soil with rapidly decreasing quantities down to 6 ft. where it practically disappears. Patterns similar to those produced by organic matter are apparent for methane for the upper part of most holes. Within this same zone, however, the ethane and heavier hydrocarbons are all present in very small amounts. The data, therefore, tend to link methane to organic matter in the upper few feet of each hole but, for the case of ethane and heavier hydrocarbons, no such relationship exists.

The first two holes, located in the background area to the southwest of production, contain relatively small amounts of hydrocarbons and organic matter below 4 ft. Not until the third station of the profile is reached, do appreciable amounts of ethane and heavier hydrocarbons appear. Here, too, the methane begins to appear in the lower parts of the holes. The first appearance of ethane occurs at the edge of Bonney oil field. The change in methane patterns for the lower parts of the holes, where the organic matter is negligible, also occurs here. Therefore the ethane and heavier hydrocarbons probably originate in the petroleum deposit itself. The same source is suggested for the methane in the lower portions of the holes.

The lower part of Fig. 3 shows the distribution pattern produced over Bonney oil field is an incomplete halo with relatively high hydrocarbon concentrations around all sides except the northwest. A fault, upthrown to the southeast, limits production on this side of the field. The low concentrations suggest that hydrocarbon leakage across the fault plane is restricted. This phenomenon has been noted before. It suggests a zone of reduced permeability occurs at the intersection of a fault and petroleum accumulation.

Well cuttings . . . To determine if a relationship exists between organic matter and hydrocarbons at greater depths than those included in Fig. 3, a series of cuttings, collected at 30-ft. intervals from the 4 Seaberg located in Martha oil field at Liberty Coutny, Texas, was analyzed for organic matter after hydrocarbon determinations were made on separate portions of composite 90-ft. samples. The data appear graphically in Fig. 4. Only small variations in organic matter were observed for the entire section for which samples were available. Methane was found in relatively small amounts which occurs normally. Ethane and heavier hydrocarbons, however, show a distinct build-up down to 8,220 ft. Below that depth hydrocarbon concentrations decrease. No apparent relationship exists between the organic matter and the hydrocarbons, particularly those heavier than methane. The only explanation for the hydrocarbon

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buildup that appears logical to the author is the presence of a commercial petroleum accumulation at 8,178-93 ft. Additional data which link hydrocarbons above a deposit, to the deposit itself, have been presented previously.

Colorado oil field . . . Fig. 5 shows the ethane and heavier hydrocarbon data obtained in the vicinity of Little Beaver oil field of Washington County, Colorado, which was discovered in 1952. The survey, conducted in the fall of 1954, includes 175 stations sampled at 12 ft. The contour lines enclose values ranging from 50-99; 100-149 and 150 p.p.b. and above. Although data are limited, a large anomalous area is recognized easily in the east half of the area sampled. The highest concentrations tend to be located at the edges of the anomaly with values of an intermediate range over the central portion, suggesting a halo type of pattern. To the southwest of the main feature, a small anomaly is apparent and, to the east, a lead is developing.

Fig. 6 shows the same data as that of Fig. 5 plus the development to August 1956. The large producing area representing Little Beaver oil field has a configuration very similar to that produced by the hydrocarbon data, and the small anomaly to the southwest is associated with a very small producing area. This survey suggests two interesting observations:

1. The ranges of values that are associated with both the anomalous and background areas are the same as those obtained in other petroleum provinces. For example, they are similar to those of the areas located in the Gulf Coast of Texas which appear in Figs. 1 and 3 and which contain entirely different geologic sections.

2. The type of trap which produced Little Beaver oil field is a permeability pinchout across a slight structural nose. This kind of trap normally can be located only by random drilling.

Field procedure . . . The sampling plan in conducting a survey is dependent upon the problem at hand. In broad reconnaissance surveys in search of large features, much time is saved by first taking samples ¼ to ½ mile apart along profiles about 1 mile apart. If the analytical data indicate a hydrocarbon anomaly of interest, additional samples are taken to produce a more dense and uniform sampling pattern within the interesting area. This program is particularly adaptable to areas that are sectionized. In areas covered with a network of roads, sampling along these roads facilitates the reconnaissance survey. The actual sampling density that is used depends upon the areal extent of the features expected.

For example, when sampling flanks of piercement type of domes, where accumulations may be only several hundred feet wide, stations are often no more than 200 ft. apart. Generally, a satisfactory sampling depth range is 8 to 12 ft. Satisfactory data are obtained in some regions from samples collected at much shallower depths. Such is the case, for example, in a large part of West Texas where the limestone and caliche near the surface occlude hydrocarbons and prevent their rapid escape to the atmosphere. The bore holes may be dug with a bucket type of hand auger or with mechanical drilling equipment.

Laboratory procedure . . . The gases are extracted from approximately 100 g. of undried sample in a partial vacuum and at temperatures below 100° C. After removing impurities by passing the extracted gases through scrubbing agents, the hydrocarbons are separated, under a high vacuum and at a temperature of —196° C., into two fractions, one containing methane and the other, ethane and heavier hydrocarbons.

The quantity of methane present is calculated from the amount of carbon dioxide produced when the noncondensable fraction is burned over a hot platinum wire in the presence of pure air or oxygen. The heavy fraction is volatilized and its volume is determined. The gain in volume of carbon dioxide, produced by combustion of this fraction, over the initial volume is a measure of the quantity of ethane and heavier hydrocarbons present. The analytical results are expressed in parts per billion by weight on the dry-sample basis. The moisture content, required for the calculations, is determined from a portion of sample separate from that used in the analysis.

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BOOKS

TWO NEW REFERENCE BOOKS ON NORTH TEXAS are being distributed by Rinehart Oil News Co., P. O. Box 1208, Dallas.

One of the books is a 235-page volume covering the development history of 274 fields in Cooke, Denton, Foard, and Grayson counties. The other is a 208-page volume reporting the same type of information on 264 fields in Hardeman, Jack, and Knox counties.

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MANUAL OF OIL AND GAS TERMS. By Howard R. Williams and Charles J. Meyers. Published by Matthew Bender & Co., Inc., 443 Fourth Avenue, New York 16. 282 pp.

This book will be useful to lawyers, land men, investors in oil and gas properties, and others in the industry. Many of the terms are legal terms and have been made intelligible to laymen yet the description tells enough to help the lawyer.

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Since many oil and gas terms lack a standardized meaning, usage varies from place to place, or the same word conveys several meanings, ambiguities have been noted.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

EXPLORATION THIS WEEK

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New Mexico	**252**
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Texas	**259**
Washington	**260**
Wildcats	**262**
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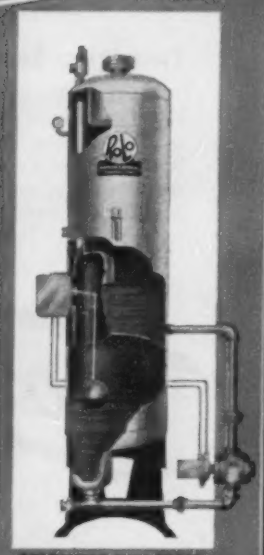

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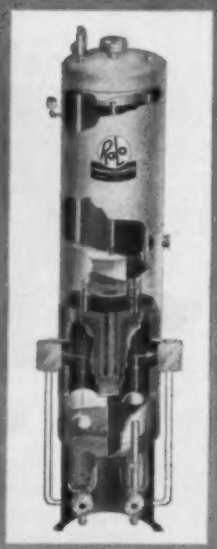

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EXPLORATION HIGHLIGHTS

APPALACHIAN

PENNSYLVANIA

Two Deep Tests Planned

Peoples Natural Gas Co., has announced locations for two new deep tests in Mount Pleasant Township, Westmoreland County. They are on the Donegal Quadrangle No. 2-4154 M. I. Keck, elevation 1,920 ft., is 5.60 miles south of latitude 40° 15′, and .60 mile west of longitude 79° 25′. No. 1-4153 Porch, elevation 1,840 ft., is .20 mile south of latitude 40° 10′, and .90 mile west of longitude 79° 25′.

WEST VIRGINIA

Randolph County Wildcat Completed as Gas Well

In Dry Fork District, Randolph County, Columbian Carbon Co.'s wildcat, No. 2-1263 U.S.A. Department of Interior, had an initial open flow of 13,363,000 cu. ft. of gas, natural, in the Oriskany sand, total depth 4,914 ft., with elevation of 3,020 ft. Rock pressure was 2,000 psi. in 24 hours.

In Gore District, Hampshire County, Anburn Oil & Gas Co., announced location for No. 1 W. G. and Nettie Arnold wildcat, elevation 1,278 ft. It is in Hanging Rock Quadrangle, 1.60 miles south of latitude 39° 20′, and 3.28 miles west of longitude 78° 35′.

CALIFORNIA

New Zone for Shiells Canyon

The 46-year-old Sheills Canyon field in Ventura County was the scene of a discovery when The Texas Co. found a new zone between 6,396-6,835 ft. in a wildcat located south of the main productive area. The well, 16 Elkins, was completed on the pump making 231 bbl. daily of 28°-gravity crude through a 21/64-in. choke.

Big Well for Humble At Fillmore Field

Humble Oil & Refining Co. continued its record of bringing in excellent producers in the Fillmore field, Ventura County. Its latest success is 6 Eddie Perkins. It was dually completed making 413 bbl. daily of 33-gravity crude, 15/64-in. choke from the Perkins zone at 13,765-13,810 ft., and 422 bbl. daily of 32.4°-gravity crude from the Spaulding zone at 13,-897-13,913 ft. and 13,920-50 ft. Total depth is 14,045 ft.

Union Completes Mountain View Extension

Union Oil Co. completed an extension to its Houchin area discovery in the southern edge of Mountain View field in Kern County, with a pumping well about ½ mile northwest of the discovery. The new well, 42-27 Union - Hancock - Pomeroy-Schuman, was put on the pump for 177 bbl. daily of 34.1°-gravity crude from perforations at 8,226-63, 8,282-8,306, and 8,356-72 ft.

Texaco Taps Deep Pool at Bridge Area

The Texas Co. recently found a still deeper pool in the Bridge area of South Mountain field, Ventura

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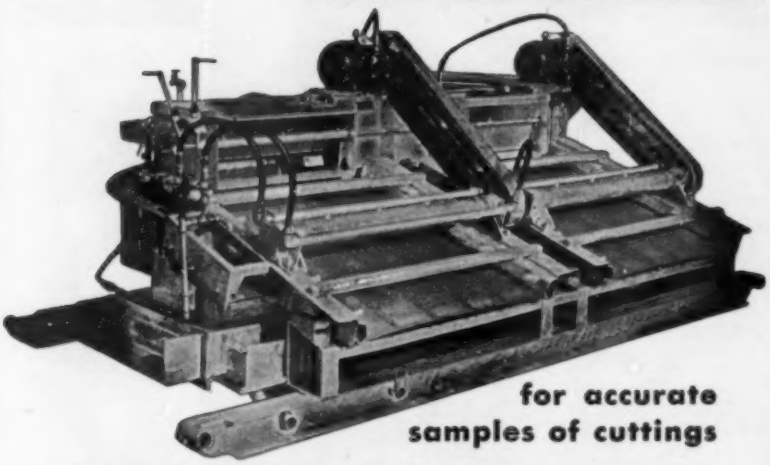

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County, with a 13,412 ft. wildcat in SW 14-3n-21w, about ¼-mile south of the nearest producer in the Bridge pool. This wildcat, 1 Texas-Union-Richardson heirs, was perforated at 11,000-05 and 11,109-12,280 ft. While probably subcommercial as a pumper making only 18 bbl. a day, it points up the great potential still present in the Bridge are activity. This drilling involves going through the major fault in the area to formations younger than those on top the fault. Bridge pool wells are generally completed in the 7,000 to 9,000 ft. range.

CANADA

Alberta Wildcats Look Good

Mobil Oil of Canada, Ltd., has two indicated discoveries, one oil in the Leslieville area, 37 miles west of Red Deer, and the other gas in the Goose Creek region, 85 miles northwest of Edmonton.

The prospective new production in the Leslieville area is in Viking sand, from which 3,100 ft. of clean oil and 270 ft. of gas-cut mud was recovered in a drill-stem test of 133-ft. interval below 7,108 ft.

Production in the area has been gas from the Mississippian and oil from the Cardium sand. Mobil's well, in LSD 4, 19-39-5w5, is 3½ miles southwest of Imperial Oil, Ltd.'s, Cardium oil-discovery well in the area. It is 14 miles northwest of the Hespero Mississppian gas and oil region.

The indicated Viking pay is being passed up for the time being to take the hole to its scheduled Precambrian basement objective about 11,000 ft.

The prospective new gas production in the Goose Creek region is from basal Blairmore. Mobil's indicated well, in LSD 10, 20-62-8w5, had gas at the surface in 5 minuts and flowed at an estimated rate of 5,000,000 cu. ft. per day in a drill-stem test of that formation at 4,250 ft. Pipe recovery, however, was 600 ft. of muddy salt water.

Hole now is being deepened to lower objectives, principally the Beaverhill Lake horizon, in which recent oil and gas strikes in the region have been made. Its location is 33 miles southeast of the Home-Regent-Edith Lake 11-19 Beaverhill Lake oil-discovery well.

The Leslieville discovery is on a wholly owned block of 81,784 acres. The one in the Goose Creek region is on a tract of 92,160 acres.

Blood Indian Strike Looms as Important Hit

The best oil prospect in some time for the southern protion of Alberta has been indicated by Pan American Petroleum Corp. at its current exploratory test in the Blood Indian Reserve region, 33 miles north of the International boundary and 115 miles south-southeast of Calgary. Usually drill-stem tests in the Mississippian, indicating production at this well, give up small amounts of oil-cut mud but this recent strike has recovered small but encouraging amounts of free crude.

This venture, Pan American A-1 I.R. Blood, on LSD 8, 23-6-24w4, lies 20 miles southwest of Lethbridge, 34 miles northeast of Pincher Creek gas field and 5 miles northwest of the Imperial 1 Blood wildcat abandonment.

Initial drill-stem test in the horizon

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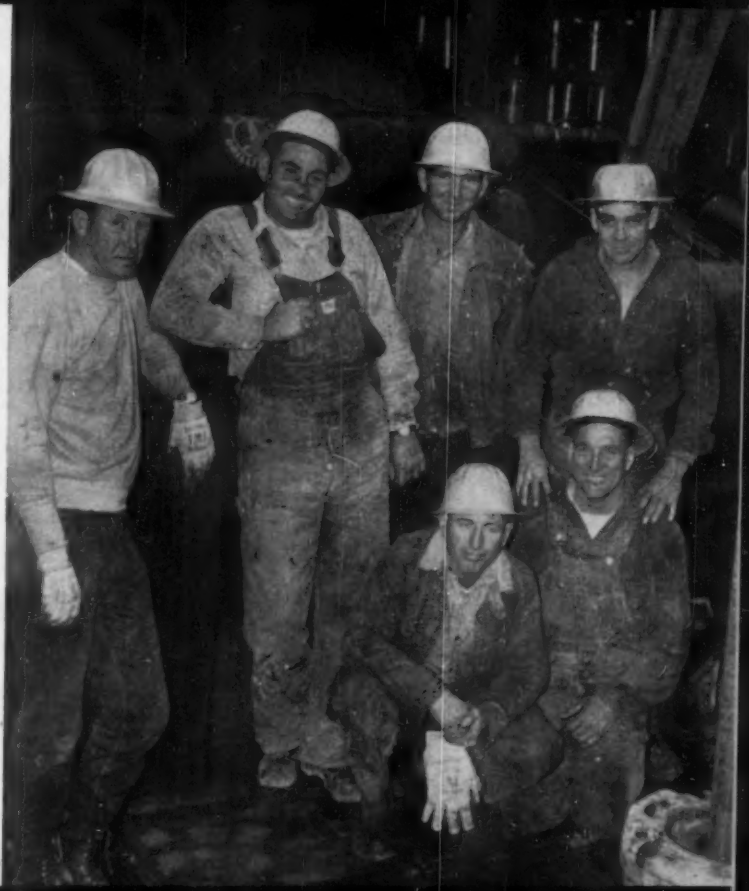

This happy FWA crew pictured from left to right is L. W. Sexton, Driller; C. L. Sims, Floorman; H. A. Goehring, Floorman; G. T. Sims, Floorman; Kneeling are George Whiteside, Floorman, and E. R. Quisenberry, Derrickman.

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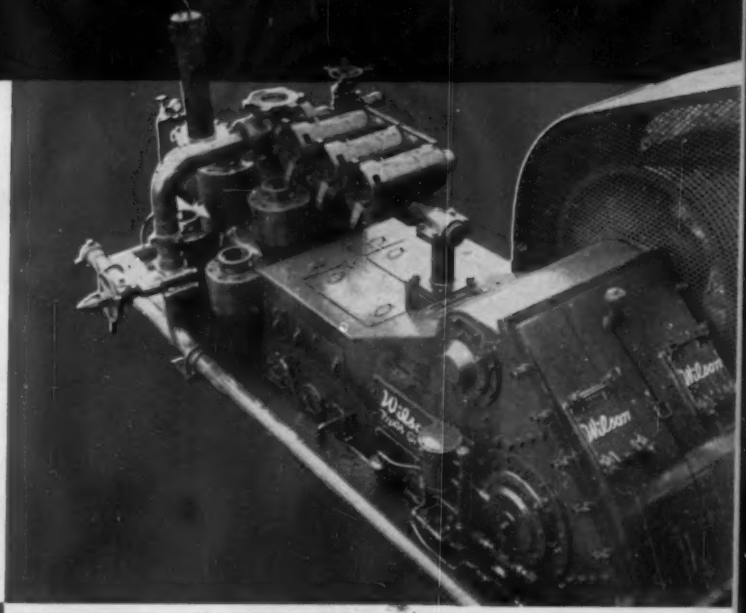

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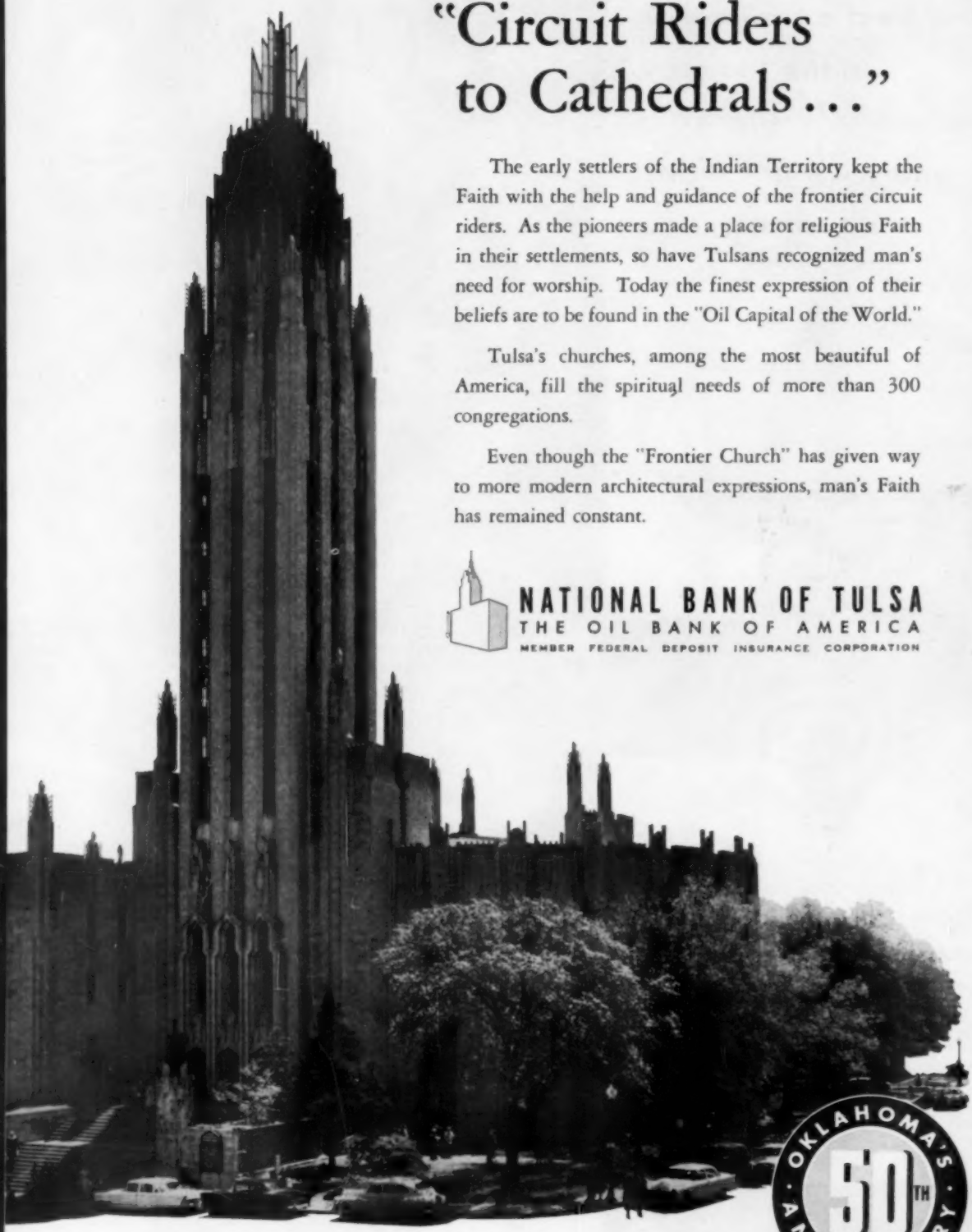

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gave up 180 ft. of gas-cut mud, 165 ft. of gassy oil-cut mud and 10 ft. of clean oil; while the second attempt recovered 90 ft. of gas-cut mud 100 ft. of gas and oil-cut mud and 220 ft. of clean, 42°-gravity oil. Those evaluations covered a total of 56 ft. of zone and upon completion of the second test an additional 30-ft. core, which indicated the oil-section had been penetrated, was taken. Crew of the drilling rig employed at the hole then resumed drilling operations but it is thought that casing will be set on the venture and attempts to complete the well commercially will be made.

BRITISH COLUMBIA

East Alces Is Latest Oil Discovery in Province

The Imperial Oil, Ltd.-Pacific Petroleum, Ltd., team that has been carrying out an intensified drilling program in the Boundary Lake region of northeastern British Columbia during the past year or two was rewarded with another oil discovery in that region recently. The newest find in that region, which borders on the Alberta Boundary 320 miles northwest of Edmonton, will need further evaluation before its commercial aspects are known, but it has been rumored that it is possibly one of the better finds outside of the main field area which lies 7 miles north.

The well, Imperial-Pacific 14-20-84-13 Alces East, on LSD 14, 20-84-13w6, lies 2¾ miles east-northeast of the Imperial-Pacific 1-23-84-14 Alces discovery hole and 5½ miles southeast of the Imperial-Pacific 11-10 Southwest Boundary Lake wildcat oil strike.

Production at the new well, was indicated in the Boundary Lake-Triassic formation, when a drill-stem test covering an 80-ft. interval gave up 30 ft. of sulfurous gas-cut oil with some gas-cut mud. Total depth was reached at an elevation 500 ft. lower than the tested interval and according to unofficial word, the group will now carry out completion procedure.

ILLINOIS BASIN

ILLINOIS

Multipay Discovery Seen For Jefferson Area

Kewanee Oil Co. 1 Jeff, SE NW SE 23-4s-2e, 10 miles south of Mount Vernon in Jefferson County, is a multipay discovery.

Casing has been set to test the Renault sand at 2,644-62 ft., the McClosky at 2,777-89 ft., the Salem at 3,256-64, 3,268-86, and 3,374-3,422 ft., and the Warsaw at 3,456-66 ft. Five commercial drill-stem tests were run at this wildcat.

Dual Discovery Reported At Clay County Well

Willard McKinney 1 L. Walburn, NW NE NE 19-4n-8e, just north of Sailor Springs in Clay County, is both a Rosiclare and McClosky discovery.

Pumping equipment is being set up at the well after the operator swabbed 23 bbl. of oil per hour from both zones after acid treatment at 2,981-86, 2,991-93 ft. in the Rosiclare and at 2,999-3,002 ft. in the McClosky.

Rosiclare Discovery Seen At Effingham Wildcat

Commercial production is indicated at a wildcat in Effingham County, just north of Watson.

Slagter Producing Co. has set casing at 2,415-31 ft. at the 1 Selma Wenthe, SE NE NE 24-7n-5e in Effingham County. The operator got 100 ft. of

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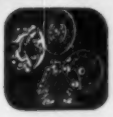

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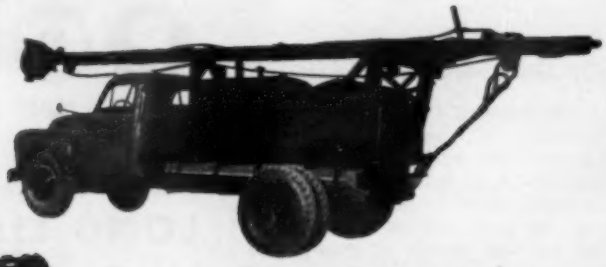

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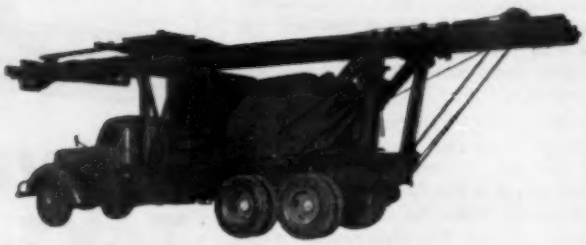

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gas, 20 ft. of oil and 60 ft. of heavily oil-mixed mud on a 1-hour drill-stem test at 2,405-19 ft. Pay is the Rosiclare.

Devonian Discovery On Pump in Washington

C. E. Brehm has a Devonian pumping discovery at his 1 Mildred Garlich Unit in SE SE NE 6-1s-4w, 3 miles northwest of Okawville in Washington County.

The well is pumping 100 bbl. of oil per day from Devonian at 2,178-90 ft.

LOUISIANA

NORTH

Sparta Discovery Opens Concordia Parish Field

Marlin Exploration, Inc., has completed its new discovery well 2 miles west of Warnicott, in Concordia Parish, with a potential gage of 96 bbl. of 24.8°-gravity oil per day, flowing through 9/64-in. choke. Flowing pressure is 220 psi. It opens a new Sparta-sand field, officially named "Warnicott."

Its Sparta pay is perforated at 3,224-25 ft. Hole was drilled to 6,813 ft. Nearest other Sparta production is 20 miles northwest in Larto Lake field. Esperance Point, nearest other field located 2 miles southeast, produces from Wilcox sand.

SOUTH

Bastian Bay Area Wildcat Opens New Deep Gas Field

A deep wildcat located about 4 miles east of the Bastian Bay area, Plaquemines Parish, is being completed as a dry-gas well.

It is the joint operation of Hunt Oil Co. and Pan American Petroleum Corp. at 1 Louisiana Land & Exploration Co., in 42-20s-30e.

Tested through small chokes, the well flowed at the rate of 4,700,000 cu. ft. of gas per day with pressure of 3,900 psi. Completion is in Miocene sand, perforated at 13,255-61 ft. Total depth is 13,380 ft.

Nearest production in the Bastian Bay area is Tidewater Oil Co.'s recently completed deep gas well about 3 miles southeast of the original Bastian Bay field. It is about 2 miles south of Fort Jackson field, on the south bank of Mississippi River, where one gas well has been completed (1955) in a 10,800-ft. sand.

New-Pay Gas Discovery Extends Grand Lake Area

Production in the Grand Lake area, northeastern Cameron Parish, is being extended a mile westward by a new gas-condensate well completed by Gulf Oil Corp.

Completion of the well, 1 State Lease 3014, in Grand Lake, opens a new pay-zone for the area. Pay is perforated at 10,588-10,602 ft. Hole was drilled to 12,000 ft.

Flow on potential test through small chokes was at the rate of 78 bbl. of condenstae and 1,630,000 cu. ft. of gas per day. Pressure was 5,900 psi. Gravity of the liquid recovery is 44.8°.

MICHIGAN

Hope Field Deep Test Heading for Saint Peter

McClure Oil Co. 1 Hibbard, NW SE 34-2n-9w, Barry County, drilled Trenton lime from 4,196 to 4,725 ft. without commercial shows, and will be cored to 5,300 ft. to test Saint Peter sand. Test is in old Hope shallow oil field and first in area to drill Trenton. Carter Oil Co. is affiliated with McClure in test.

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JENSEN JACKS

Edmore pool, Montcalm County, was extended ½-mile southwest by Glendenning & Mutch 1 Jensen, SE NE 9-12n-6w, producing 35 bbl. of oil per day from Traverse lime at 3,063-92 ft.

NEW MEXICO

Lea County Gets New Discovery

Official completion has been announced by Pure Oil Co. for its 1 State-Lea, discovery well, or long extension in an area studded by new field openers.

Daily potential was 1,440 bbl. of 44-gravity oil, based on a 4-hour flow test of 240 bbl. of oil through 14/64-in. choke. Pennsylvanian pay was perforated between 11,446-76 ft. Gas-oil ratio was 1,350:1.

Location in SW SE 21-16s-34e is 2½ miles west in the Seaman-Pennsylvanian field, while nearest production of any kind is approximately 1 mile northwest in the Kemnitz (Permo-Pennsylvanian) field, which has pay around 10,732 ft.

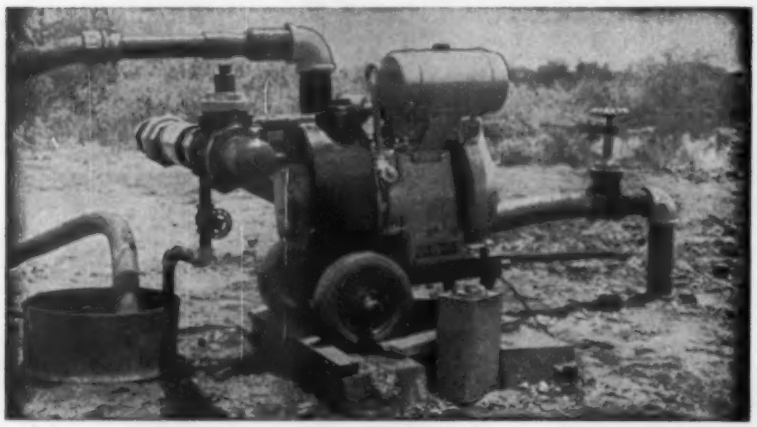
Pure has made location for 2-E State-Lea as a ½-mil esouth offset to the field discovery.

Second Well Tests In Sombrero Area

Phillips Petroleum 1 Michel was showing for a second producer, and extension, to an Atoka gas-distillate discovery in western Lea County.

Phillips' well drilled to 13,265 ft., then plugged back to 13,246 ft. On tests through perforations at intervals between 13,062-13,200 ft., the well flowed 238 bbl. of distillate, plus gas at the rate of 5,874,000 cu. ft. per day. The gage was through ⅜-in. choke.

No. 1 Michel is in NE NW 13-16s-33e. It is ¾-mile southeast of Skelly Oil Co. 1 Sombrero Unit, which opened gas-distillate production from the Atoka section of the Pennsylvanian.



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OKLAHOMA

PANHANDLE

Good Well Completed In Highland District

Shell Oil Co. completed a good Hoover-Pennsylvanian sand well in the south section of Beaver County's Highland field. The 1-A Moore, C NW SE 18-3n-28eCM, flowed 50,000 M.c.f. of gas per day plus 4 bbl. of distillate per million from perforations at 4,450-84 ft.

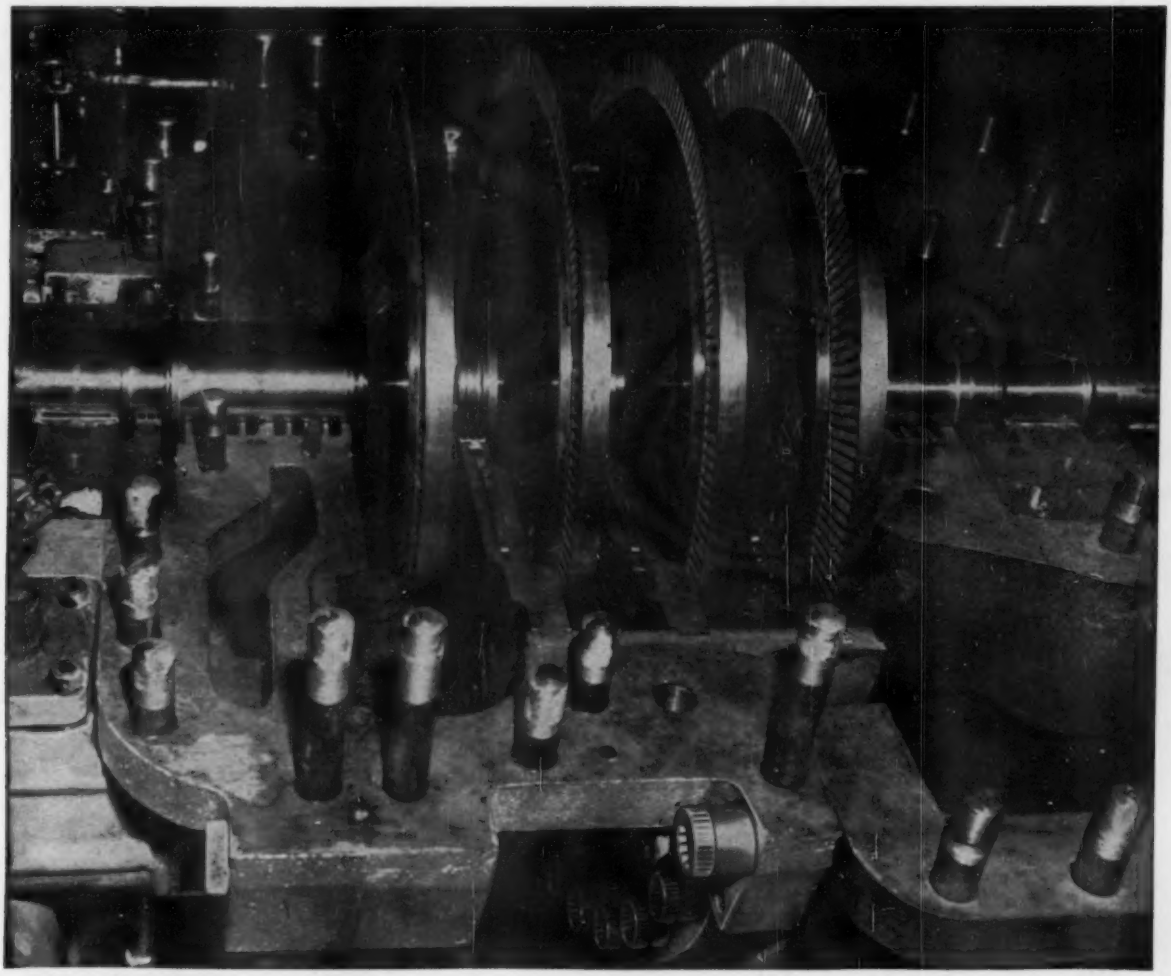
The north side of the field was also extended as a result of Cabot Carbon Corp.'s 1 Whisenhunt discovery in 34-4n-28eCM. It flowed 9,010 M.c.f. of wet gas per day from perforations at 6,896-6,930 ft.

NORTHWEST

Extension Discovery Finaled in Woods County

The Texas Co. has successfully extended Northeast Waynoka field in Woods County at its 1 Barker Unit in SW SW SE 29-25n-15w, 1½ miles south of production.

The well made 5,370 M.c.f. of gas per day and 11 bbl. of condensate per



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day on ½-in. choke from perforations in the Cottage Grove-Pennsylvanian at 5,592-5,606 ft.

East Side of Laverne Field Extended

Harper County's Laverne district was extended to the east at Sinclair Oil & Gas Co.'s 1 Neff Unit in C SE NW 17-26n-24w. The Hoover sand well made 3,780 M.c.f. of gas per day on 30/64-in. choke from perforations in the Hoover sand at 4,340-60 ft.; from the Chester-Mississippian at 7,067-7,130 ft. it flowed 1,630 M.c.f. per day and 18 bbl. of condensate in 12 hours.

Sinclair Will Make Second Attempt in Woodward

Sinclair Oil & Gas Co. will drill a second well in the new pool in Woodward County at 1 Withgott Unit, C SE NW 2-23n-20w.

The new well is the west offset to the 1 Gilbert discovery in C SE NW 1-23n-20w. That well flowed 3,500 M.c.f. of gas per day on 1-in. choke from lower Morrow-Pennsylvanian at 7,523-38 and 7,567-71 ft.

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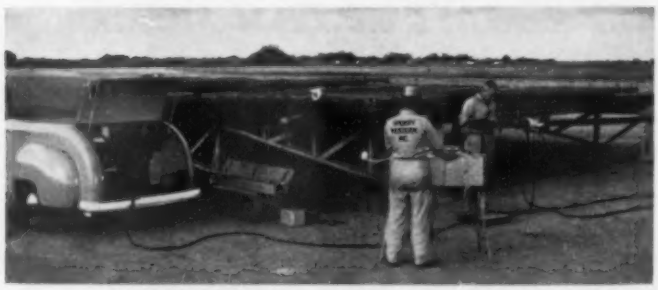

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SOUTHWEST

Third Well Added to Sinclair's Susie Area

Sinclair Oil & Gas Co. 2 Susie, C SE SE 1-6n-13w, is the third indicated producing well for famous Northeast Alden pool in Caddo County. The operator found oil in the first and second Bromide sands. A test at 8,762-8,807 ft. recovered 2,055 ft. of oil and gas, 75 per cent oil. Another test at 8,904-84 ft. got 3,834 ft. of oil and 80 ft. heavily oil-cut mud. There was also oil in the Chester at 3,860-3,906 ft. and in the Woodford chert at 6,121-76 ft. These would be new-pay discoveries for the field.

ROCKY MOUNTAINS

WYOMING

Sherwood New Pay Well Increases Liquid Yield

Additional testing in Pan American Petroleum Corp.'s second well on its Sherwood Unit, 6 miles northeast of East Salt Creek field, in northeastern Natrona County, in making this new-pay discovery appear even much better than it did on earlier tests.

During a late 14-hour test of its new pay, in Frontier sand, perforated at 9,534-48 ft., the well flowed 300 bbl. of condensate with gas at the rate of 3,349,000 cu. ft. per day. Flow was restricted to 5/32-in. choke, through which pressure was 1,725 psi.

Previously, only gas was tested, although this was at the rate of 10,800,000 cu. ft. per day.

Location is southwest of the company's initial test, originally completed in the Lakota, and later recompleted in the Muddy sand. The new well, drilled to 11,015 ft., found the lower zones commercially unproductive.

Table Rock Area Gets First Oil Production

Sweetwater County's Table Rock field, previously productive only of gas from the Wasatch and Almond horizons, has proved oil productive in a well The Texas Co. has just completed east of the gas area. Completion also is in the Almond (Mesaverde) but from a lower interval at 6,532-50 ft. On the pump, the well is good for 125 bbl. of net oil per day, making, in addition, about 26 bbl. of water. Before pumping, it flowed at the rate of 74 bbl. per day.

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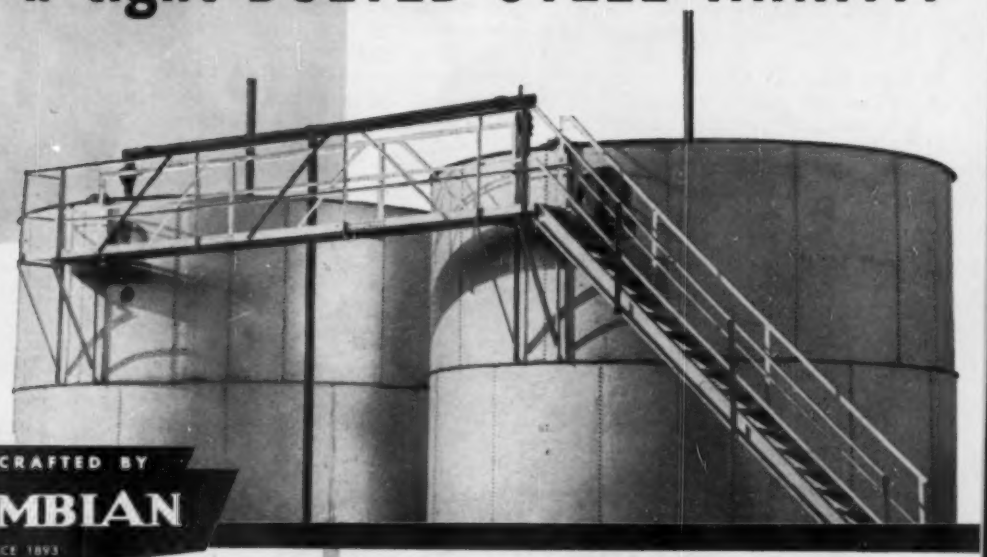

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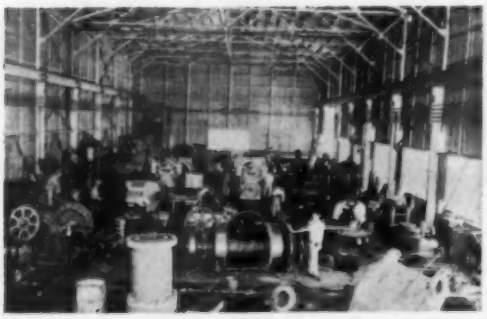

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Shallow Gas Pay Proved In Bison Basin Wildcat

A small, shallow Dakota gas-discovery is reported by Gu f Oil Corp. at its 1 Federal, in 9-27n-95w, on its Trail Ridge block, in southeastern Fremont County. It is about 1½ miles northeast of Frontier gas production in Bison Basin field. Flow of 862,000 cu. ft. of gas per day was recorded on tests through ¼-in. choke. Hole was drilled to 3,990 ft., in Tensleep. Dakota is perforated at 1,416-40 ft.

MONTANA

Glacier County Wildcat Gets Madison Production

Madison oil production is being opened in a wildcat between Cut Bank and Blackfoot fields in northeastern Glacier County.

The discovery is by Murphy Corp. at its 1 State, in 23-37n-6w, which swabbed at the rate of 366 bbl. of oil with about 32 bbl. of water per day from open hole at 3,262-80 ft. in the Madison. Pay was acidized.

Location is about 3 miles northwest of Cut Bank field, and about 2 miles south of Blackfoot field.

NORTH DAKOTA

New Oil Discoveries Dot Northern Burke County

Three more encouraging oil discoveries are reported in the Lignite area, in northern Burke County, North Dakota.

Latest is by Northwest Oil Drilling and Central Le Duc at their 1 Klitzke, in 17-163n-91w, about 4 miles north of Lignite field. It has been placed on the pump and is making oil, although the amount has not been reported. Its production is from the Mississippian-Midale zone, perforated at 5,981-92 ft.

This is 5 miles west of a previously reported discovery by Central Le Duc, its 1 Bird, in 18-163n-90w, which is being put on the pump after swabbing and flowing about 5 bbl. of oil (net) per hour from the Midale at 5,723-34 ft. The oil recovery was with about an equal amount of acid water.

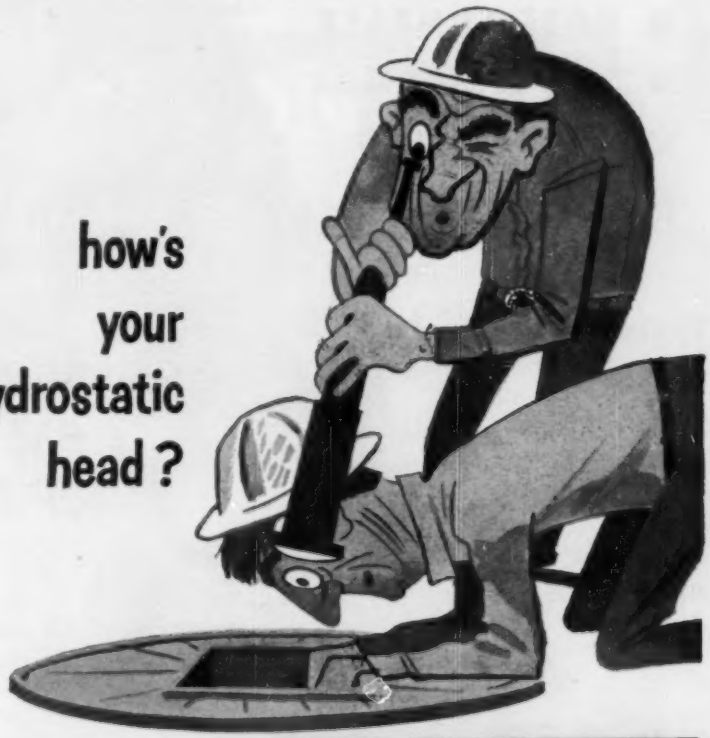
About 3½ miles southeast of nearest production in Lignite field, another new discovery-well, 1 Jorgens, drilled by Petroleum Corp. of America and Tom Jordan, Jr., is pumping about 250 bbl. of oil per day. Its production is from both the Midale zone, perforated at 6,253-61 ft. and 6,265-71 ft., and the Nesson, perforated at 6,276-88 ft. The better of the two zones is the Nesson, from which the well, before going on the pump, had swabbed and flowed at rates up to 24 bbl. per hour.

Most prolific of the new discovery wells has been Arrowhead Exploration Co.'s 1 Propst, which was completed earlier with an initial flow of 56 bbl. of oil per hour. This well, in 17-16s-92w, is about 7 miles northwest of Lignite field, and about 6 miles west of the above-mentioned Northwest Oil Drilling and Central Le Duc discovery. Arrowhead's well, now shut in for storage, is perforated at 6,080-82 ft. and 6,092-98 ft., in the Nesson, and at 6,067-70 ft., in basal Midale and upper Nesson.

UTAH

Good Oil Flow Recorded In New Paradox Discovery

Reynolds Metals Co. and Three States Natural Gas Co. are completing their new Paradox basin discovery well with a daily flow rate of 235.2 bbl. of 43.2°-gravity oil. The flow is based on a 6 hour gage through



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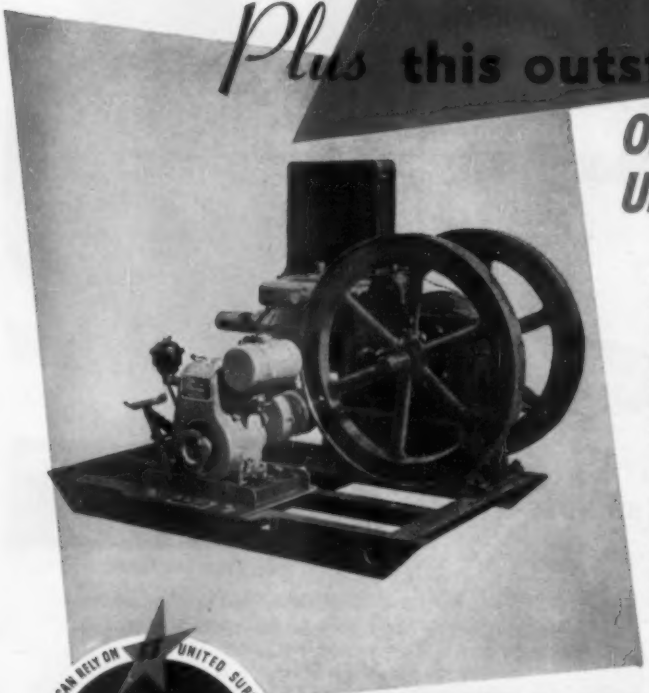

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¼-in. choke. It was under pressure of 460 psi. with gas-oil ratio of 1,397 cu. ft. per barrel.

The well is their 1 Federal (Lease SL-067668), in 15-38s-24e, on their Hatch lease block, comprising 54,000 acres, in San Juan County. Location is 11 miles north of Aneth field. It is the fourth exploratory test drilled by the Reynolds-Three States combination to the "C" zone of the Paradox limestone formation, productive in the Aneth field. The first 3 tests were dry.

The pay in this well is perforated at 5,967-87 ft. with casing having been cemented on bottom at 6,047 ft. Top of the Paradox was logged at 5,522 ft. with surface elevation of 5,133 ft.

The Reynolds-Three States combine already has completed 6 producing wells in Aneth field, and also has another joint-interest well with Shell Oil Co. on another lease.

TEXAS

TEXAS PANHANDLE

Roberts County Gas Well Completed

Pan American Petroleum Corp. has completed its 7-A Lips Ranch as a Morrow sand gas discovery in northwestern Roberts County.

Estimated open-flow potential was 1,500,000 cu. ft. of gas a day, from perforations at 8,790-96 and 8,806-12 ft. Completion followed mud-acid and sand fracture treatments.

Location is 20 miles southeast of Spearman, in Section 17, Block A, H&GN Survey.

Deep test located . . . E. B. Clark Drilling Co., Wichita Falls, has made location for a 9,500-ft. wildcat in northwestern Roberts County. The well will be 1 Inez Carter, with location in Section 15, Block 46, H&TC Survey, and 27 miles north of Pampa. Nearest production is Lard field, 3 miles to the west.

WEST TEXAS

Terrell County Test Finds Additional Pay

Magnolia Petroleum Co. and Western Natural Gas Co. 1 Brown-Bassett, in northeastern Terrell County, logged additional Ellenburger gas pay section. Third drill-stem test of the Ellenburger, from 14,220-14,308 ft., blew mud and gas into pits 10 minutes after opening the tool. After blowing for 15 minutes, it was gaged at the rate of 14,000 M.c.f. a day, through 24/64-in. choke. Surface flowing pressure was 1,525 psi. Bottom-hole flowing pressure ranged from 4,060-5,180 psi. Shut-in pressure was 6,050 psi. in 1 hour.

On a subsequent test at 14,308-14,402 ft., gas volume had decreased to 80,000 cu. ft. daily, through ¾-in. choke. Flowing pressure ranged from 970-1,040 psi., and shut-in pressure read 6,470 psi. It was drilling ahead on 15,000-ft. contract.

Operators have called top of the Ellenburger at 13,742 ft., or minus 11,294 ft. Location is in Section 218, Block Y, TCRR Survey. There is no nearby production.

Gas Kick in Deep Pecos County Wildcat

Phillips Petroleum Co. and Sinclair Oil & Gas Co. 1-A Montgomery, remote wildcat 13 miles southeast of Fort Stockton in central Pecos County, reported a heavy gas kick at 10,122 ft., in the Wolfcamp. Plans were to drill ahead 20 ft., and drill-stem test the section if samples warrant it.

No. 1-A Montgomery is located in Section 17, Block 134, T&STL Survey. It was started in June, with a projected depth of 22,0000 ft.

Reports from other Pecos County

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deep projects were: Pan American Petroleum Corp. 1 CS University, present depth record holder, was held up by stuck drill pipe at 21,687 ft. Location is 15 miles southeast of Fort Stockton.

Phillips Petroleum Co. 1 EE University, due east of Fort Stockton, was drilling below 19,227 ft. in dolomite. It is the second well to break West Texas' depth record set by Gulf Oil Corp. 1-A Northrup at 18,771 ft. in Reeves County.

Meanwhile, back on the Central basin platform in northern Pecos County, a Devonian and Queen sand opener was in the making.

Kelly Bell, W. B. Dansfield and American Trading & Production Corp. 1 Pecos County Water District No. 3, 5½ miles west of Imperial, ran a 2-hour test on the Devonian at 5,404-5,530 ft. Recovery was 1,290 ft. of mud-cut oil, plus 150 ft. of heavily oil and gas-cut mud, Flowing pressure was 180-445 psi., increasing to 2,315 psi. when shut in 30 minutes. Top of the Devonian was 5,400 ft. on elevation of 2,406 ft. Drilling continued, toward contract depth of 6,000 ft.

Queen production was indicated earlier while drilling at 2,074 ft., and again at 2,160 ft.

Location is in Section 11, Block 9, H&GN Survey, west of shallow Permian production in Malicky field.

WASHINGTON

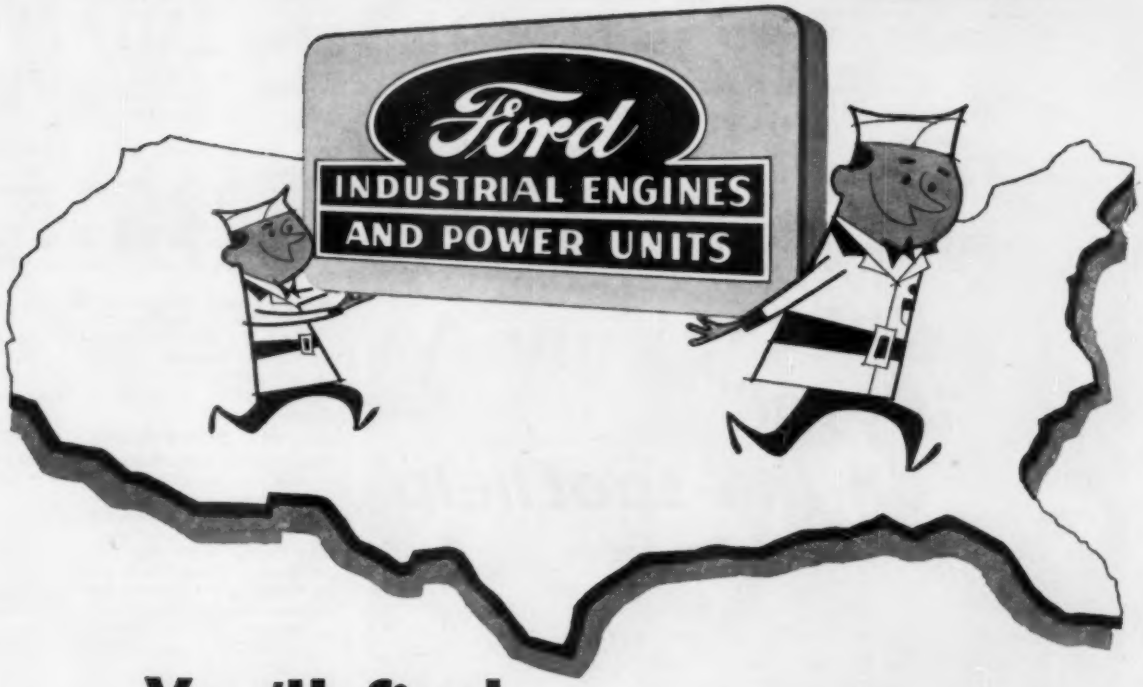
Standard-Western Test Still Drilling Ahead

Standard Oil Co. of California, Western Operations, Inc., was drilling ahead below 5,096 ft. on its 1 Rattlesnake Hills Unit in the Rattlesnake Hills of Benton County.

Sunshine Completing Second Ocean City Well

Sunshine Mining Co. was preparing to perforate the Nye zone at 4,162-87 ft. and completed its second Ocean City test as a dual completion. In addition to the Nye zone, the well also tapped a zone at 2,590-2,602 ft. This shallower zone made an estimated 5 bbl. an hour on an earlier test. The Nye zone now being perforated also was given a drill-stem test. The test was open 107 minutes and recovered 220 ft. of oil, 200 ft. of oil and gas-cut mud with a fair blow throughout the test. The well, 2 J. W. Tanner-Medina, is a northwest extension test to the discovery well.

Whether it's repair or replacement...



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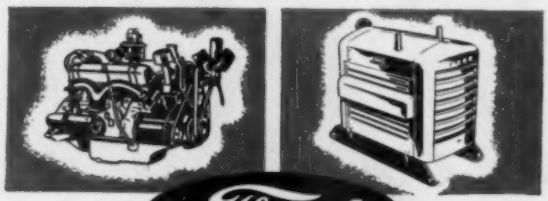

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WEST VIRGINIA

Randolph County, Dry Fork District: Columbian Carbon Co. 2-1263 U.S.A. Department of Interior, elev. 3,020 ft., 13,363,000 cu. ft., gas, natural, chert 4,553-4,618 ft., Oriskany sand 4,686-4,891 ft., gas 4,855 ft. TD 4,914 ft.

KANSAS

Meade County: Skelly Oil Co. 1 P. H. Mohler, SW SW SW 35-33s-29w. IPP 320 BOPD, 42°-gravity, Marmaton 5,259-67 ft. TD 5,906 ft.

SOUTH LOUISIANA

Cameron Parish: Austral Oil & Exploration Co. 1 Savoie, 19-14s-6w. IP 21 BOPD and 1,445° M.c.f. daily, ⅛-in., 61°, TP 4,770 psi., perfs. 10,341-47 ft. TD 10,918 ft. (New field.)

Jefferson Davis Parish: Tennessee Gas Transmission Co. 1 Morgan Plantation, 38-11s-4w (4½ miles southeast of Lake Arthur field). IP 173 BOPD, 7/32-in., 40.2°, GOR 400 cu. ft. per barrel, TP 5,400 psi., perfs. 12,808-10 ft. TD 14,825 ft. (New field.)

Plaquemines Parish: Hunt Oil Co. and Pan American Petroleum Corp. 1 L.L.&E., 42-20s-30e. Shut-in gas well, flowed estimated 4,700 M.c.f. per day, dry gas, 3,900 psi., perf. 13,255-61 ft. TD 13,380 ft. (New fie'd.)

SOUTHEAST NEW MEXICO

Lea County: Union Oil Co. of California 1 R. W. Duncan, 6-13s-36e. IP 240 BOPD, 12/64-in., 43°-gravity, Wolfcamp perfs. 10,285-10,364 ft. TD 14,393 ft. Top Devonian 14,010 ft. elev. 4,018 ft.

OKLAHOMA

Alfalfa County: Gulf Oil Corp. 1 Stover, SE SE 16-27n-9w. IP 162 BOPD, 30°-gravity, Cherokee sand 5,234-63 ft. TD 5,335 ft.

Grant County: Apache Oil Co. 1-A Jones estate, SE SE SE 4-26n-6w. IP 90 BOPD, 20/64-in., 30°-gravity, Red Fork 5,044-48, 5,054-77 ft. TD 5,215 ft.

Lincoln County: Wico Oil Co. 1 Sontag, W½ NW SW 28-13n-6e. IP 1,800 M.c.f. gas, Dutcher 3,790-94 ft. TD 4,451 ft.

McClain County: Cooperative Refinery Association 1 Walker "B," NEC NW 18-7n-2w. IP 154 BOPD, 40°-gravity, 9/64-in., Bromide 8,411-16 ft.; IP 196 41°-gravity, 9/64-in., Tulip Creek, 8,723-77 ft. TD 9,385 ft. Dual completion.

NORTH TEXAS

Jack County: Oppenheim & Briscoe 3-D Clayton, Sec. 333, TE&L Sur., 9 miles northeast Jermyn, OWDD. TD 4,917 ft., perf. Bend conglomerate 4,859-80 ft., IP 30,000 M.c.f. gas.

Wise County: Lone Star Producing Co. 1 Tarrant County Water Board Unit 3, Cochran & Col'ins Sur., A-1348, 6 miles west Bridgeport, 1¼ miles north production. IP 132 BOPD, 43°-gravity, GOR 7727:1, conglomerate 5,262-86 ft. TD 5,802 ft.

Lone Star Producing Co. 1 Craft Water Board, Unit 6, D. Moses Sur. 14, A-543, 7 miles southwest Bridgeport, ½ mile west gas production. IP 49 BOPD, 41°-gravity, GOR 5,829:1, Caddo conglomerate 4,594-4,602 ft. TD 5,800 ft.

TEXAS PANHANDLE

Lipscomb County: Sinclair Oil & Gas Co. 1 R. Paine, Sec. 944, B'k. 43, H&TC Sur., NW corner of county. IP, calculated open flow, 6,100 M.c.f. gas, Layton sand 6,442-53 ft. TD 6,500 ft. Bottom-hole pressure 2,117 psi.

WEST TEXAS

Andrews County: Pan American Petroleum Corp. 2 University 'B," 5-5-University Lands, 13 miles northeast Andrews. IPP 61 BOPD, 39°-gravity, Devonian perfs. 12,728-32, 12,760-78 ft. TD 13,355 ft., elev. 3,053 ft.

Ector County: Pan American Petro'eum 1 Fasken Operating Area, Sec. 18, Blk. 42, T1N, G&MMB&A Sur., 15 miles north Odessa. IP 369 BOPD, 12/64-in., 53.9°-gravity, GOR 814, TP 150 psi., Fusselman pay 12,270-12,320 ft.; IP 301 BOPD, ¼-in., 44.6°-gravity, GOR 1513, TP 900 psi., Devonian pay 11,540-90 ft. TD 13,142 ft.

Ector County: TXL Oil Corp. 1 Ector "TT" fee, 47-44-T2S-T&P, 10 miles southwest Odessa. IPP 92 BOPD, 31°-gravity, GOR 466, San Andres perfs. 4,290-4,320 ft. TD 4,437 ft., elev. 3,084 ft.

SOUTHWEST TEXAS

Hidalgo County: Bettis & Shepherd, Inc., 1 Ramey, Las Bonitos Banco 37, Llano Grande Grant, A-54. IP 4,000 M.c.f. daily, absolute open-flow potential, GLR 141.4 M.c.f. per barrel, 54.1°, shut-in pressure 3,610 psi., perfs. 7,628-36 ft. TD 8,000 ft. (New reservoir Cano Mexico field—6½ miles southwest of We'asco.)

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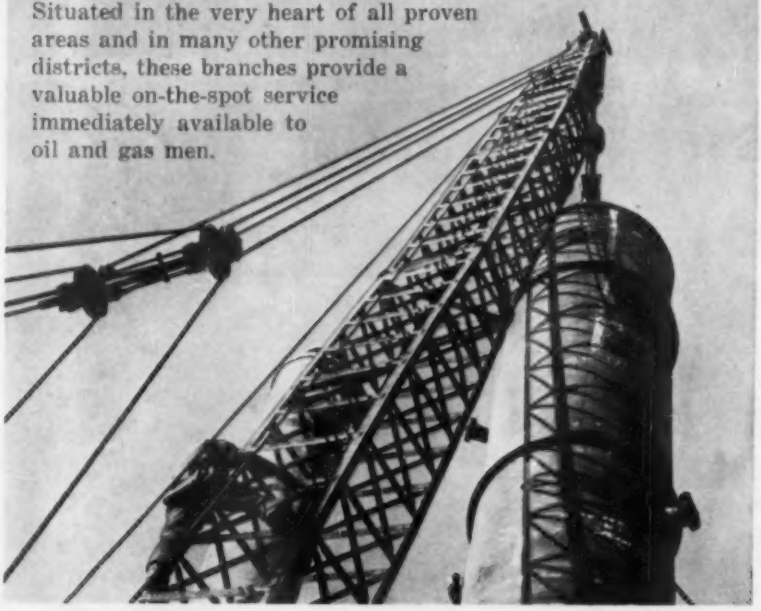

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We do not provide information on oil securities.

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Diagram and cutaway view of COSASCO Access Nipple with plug installed. (Formerly the Scotch Nipple).

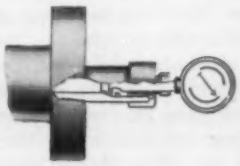
Wherever COSASCO Access Nipples are installed, you can go in against pressure with ease and perfect safety. At well heads, either the production string or annulus can be entered for instrument work. At refineries or along pipe lines, samplers, thermocouples, hydrogen probes, or coupons for corrosion studies can be inserted *without interfering with operations!* And expensive valves or other externals can be replaced or removed at will and without loss of pressure or product.

The COSASCO Access Nipple has a removable low carbon grade 303-304 stainless steel plug which, when turned down on the fine threads in the nipple outlet, effectively seals off the nipple at a tapered seat below. By-pass holes in the plug wall, between primary and secondary seals, provide communication through the plug to the exterior when the plug is backed out against a safety ring run down on the pipe threads on the nipple body.

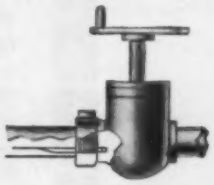
How entry is gained

With the COSASCO Retriever (Lubricator) and a full-opening valve mounted on the Access Nipple, COSASCO plugs, coupon holders or other units for inspection, testing, sampling, can be installed and removed at will regardless of pressure and without equipment shutdown. Details will be supplied promptly, on request.

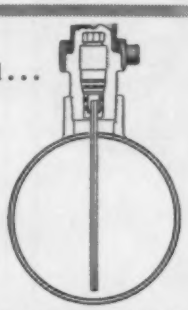
How **COSASCO** *Access* Nipples are used...



As a gauge valve, with plug installed. Gauge screws into end of plug.



As a valve re-installation nipple, with a thread and seat protector replacing the plug.



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West Texas Discovery Opens New Reef Field

NORTEX OIL & GAS CORP. 1 Shafer has been completed as a prolific Pennsylvanian discovery in northeastern Howard County, and at this writing, an offset well also had made a heavy flow from the same pay.

Nortex discovery opened another in the U-shaped chain of reef fields stretching from Scurry County southwest to Howard, thence northwest to the middle of Hockley County. These are commonly called the Horseshoe atoll reef fields. Pennsylvanian fields on the accompanying map are shown in black.

On the basis of flowing drill stem tests, 1 Shafer has an indicated 87-ft. pay section. Initial test, from the reef top at 7,454 ft., (minus 5,081 ft.), had oil to the top in 10 minutes. Flow tests on final perforations between 7,463-71 ft. gaged 332 bbl. of 47°-gravity oil in 6½ hours through 28/64-in. choke, to give the well a calculated potential of 1,226 bbl.

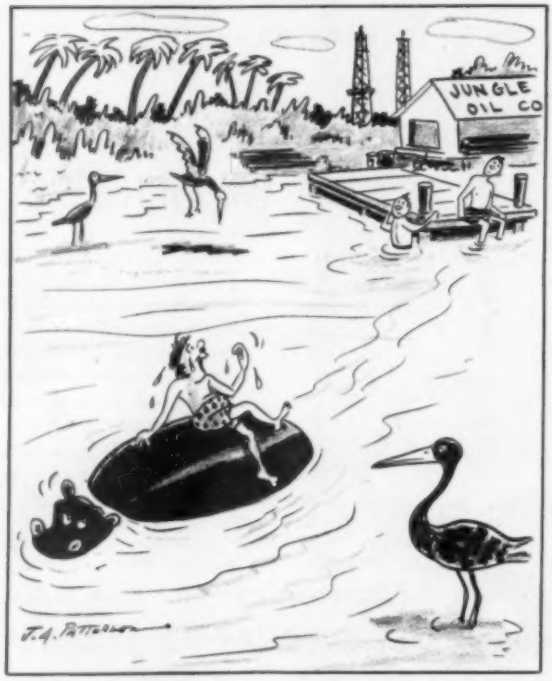
Pennsylvanian pay was struck at 1 Shafer just 20 miles northwest of Big Spring, Tex. One location east, a confirmation well reported 33 bbl. an hour through ½-in. choke.

Completion was without acid treatment. Flowing pressure was 500 psi., with gas-oil ratio of 800:1.

No. 1 Shafer also was completed from Clear Fork pay between 4,458-64 ft. Potential from that pay was 104 bbl. of 30°-gravity oil a day, following treatments with mud and regular acid. Gas-oil ratio on the Clear Fork was 300:1.

Location of the discovery is SW SW Section 57, Block 20, Lavaca Navigation Co. Survey, or 20 miles northwest of Big Spring.

THE OIL AND GAS JOURNAL



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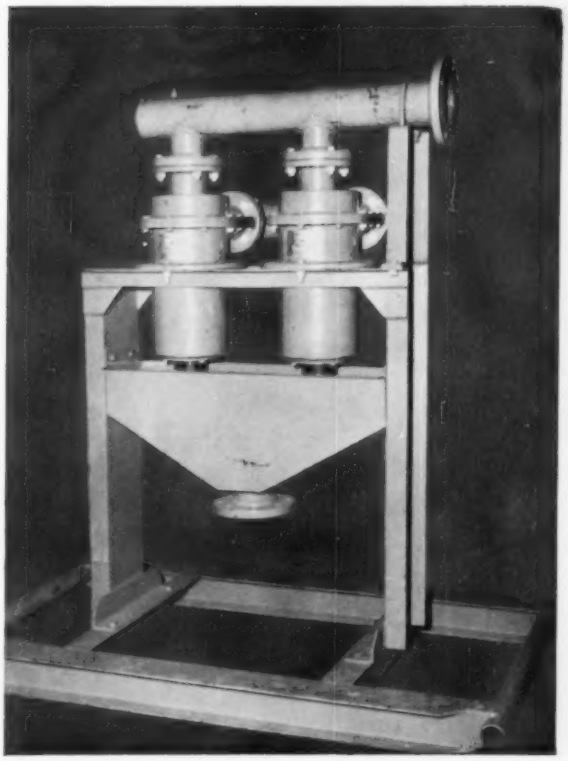

The new Size 2 Dorrco D-Sander is low in both first cost and operating cost. In addition, it is light in weight and easy to move. Designed especially for hard formation drilling with any rig, or slim hole drilling in a wide variety of formations, it brings the benefits of drilling fluids substantially free of drilled solids within the reach of every operator.

The benefits from using Dorrco D-Sanders are many. In many fields along the Gulf Coast, as well as other areas, abrasive sand can seriously reduce the life of bits and pump parts unless a D-Sander is used. In addition, the high viscosity of mud laden with drilled solids reduces drilling rates as much as 25 per cent.

In these areas, important savings in drilling costs result in that section of the hole where unweighted mud can be used.

But recent experience has proved that savings can also be realized in many other areas where abrasive formations are not encountered. In these areas, "flour sand" Dorrco D-Sanders, set to remove all drilled solids above 30 microns in size, result in greatly improved drilling speeds—sometimes in excess of 15 per cent.

In harder formations, drilling rates are slower and drilled solids are produced at a lower rate. In many of these areas, the Size 2 D-Sander, which provides capacities up to 250 gpm, is entirely adequate, yet it costs less to buy, to move and to operate than larger units.

The new Size 2 D-Sander compliments the capacity ranges of the larger sizes 4 and 6. With this new addition, Swaco offers units suitable for any rig and any drilling condition. Write for full information.

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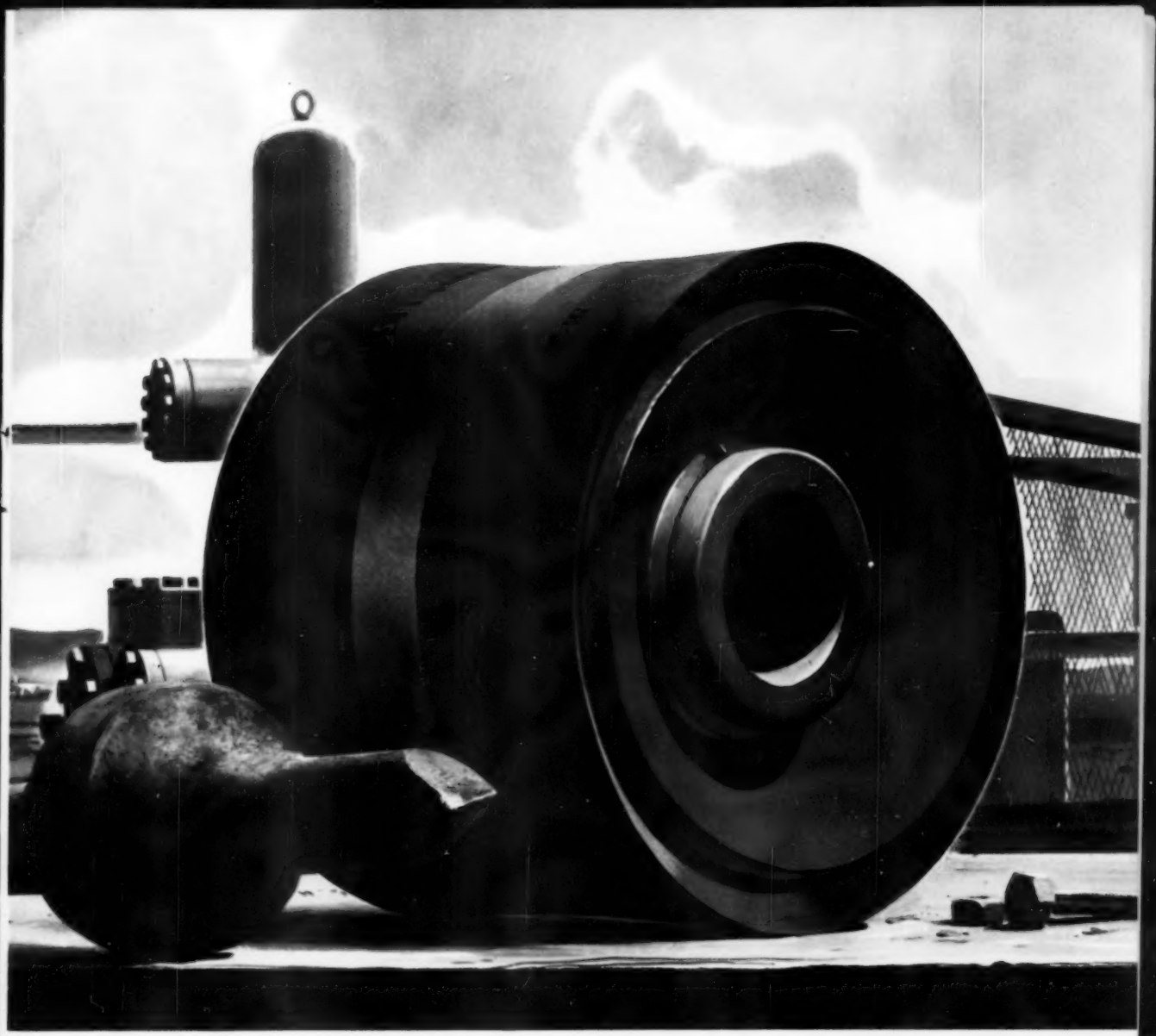

have been incorporated into Mission Pistons.

Most of these improvements, such as advances in piston rubber compounds, can't be seen, but they mean that today's Mission Pistons are giving excellent service under jet drilling conditions that would have been considered impossible only ten years ago.

In addition to the changes actually made, Mission Engineers have conducted *371 test pump laboratory and field tests on piston rubbers alone in just the last three years.* That's an average of over 120 tests per year.

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Rockies Look Good to Barrett

YOU CAN EXPECT big things from the Rocky Mountain area.

That's the optimistic outlook of A. F. Barrett, vice president and manager of production for Mobil Producing Co., Billings, Mont., and president of the 2,100-member Rocky Mountain Oil and Gas Association.

Barrett says the success of drilling activity the past 5 years and today's high level of wildcatting is paving the way for a much greater development of the Rocky Mountains as an oil province.

The oil is there, especially in elusive stratigraphic traps, but he points out it's becoming increasingly more difficult to find.

What will it take? More and more wells, he says, and an adequate price.

"The price squeeze is on in the industry. It's getting more costly to operate. So the future depends on adequate price for the crude."

A. F. BARRETT
. . . The oil's there, but it's hard to find.

Outlets . . . In comparison with some other areas, he says, the Rocky Mountain region is in an envious position, mainly because of crude and products lines going east and west.

"We're developing a position to compete in products to the west and in crude to the Midwest. So we're moving in two directions for a market." But he recalls that it hasn't always been an "envious" position for the Rockies.

"In the late 1920's when I started my career in the Rocky Mountain area, big Mid-Continent discoveries, such as Oklahoma City pool, cut the market out from under us."

But, he pointed out, in the 30's pipelines began to move more crude eastward. Then new products lines to the west put the area in a more favorable outlet position.

R.M.O.G.A. . . . When the big association met in Billings late last month it was Barrett's first role as presiding officer at a full-scale meeting since his election as president last spring.

He knows the Rockies and the people who helped build the industry in that part of the nation. One of the big forces in promoting the oil industry in that area has been the R.M.O.G.A.

To Barrett, and to other Rocky Mountain oil leaders, R.M.O.G.A. has "a record to be proud of" in its promotion of exploration, development, transportation, refining, and conservation in Montana, Colorado, Wyoming, Utah, Idaho, South Dakota, and Nebraska.

"Our association has stood strongly for a sound program. And a good deal of fine work has been done in advising government agencies and Congress in the administration of public lands," Barrett said.

This is no small matter in an area where much of the land is owned by the federal Government. The association's hard-working public-lands committee keeps its ear to the ground and nose to the grindstone on matters relating to government policy and federal leasing.

The geologist . . . Barrett, the geologist, inherited his interest in the study of the earth. He was born in Granite, Ore., in 1903, the son of a mining engineer, and grew up in Nebraska, learning the secrets of the earth at the University of Nebraska.

When he finished school he started as a geologist for Prairie Oil & Gas Co. In 1932 he set up a consulting business in Casper, Wyo. Then in 1935 he joined the Socony family as geologist for General Petroleum Corp. in Casper.

Later he was advanced to manager of exploration, and then was appointed manager of operations for General Petroleum in the Rocky Mountain area.

When Socony formed Mobil Producing Co. in 1953 to handle operations in the northern Rockies and to coordinate Socony's Canadian operations, Barrett was tapped for the job of vice president and manager of production, with headquarters in Billings.

In both Casper and Billings, he has been active in civic affairs, and considers such activity one of his hobbies.

He has headed the Casper Community Chest drive, and for 5 years he was a member of the Central Wyoming Fair Board. In addition, he has served as a director of the Casper National Bank for the past 5 years.

He and his wife have one son, who is following the family footsteps—geology. Barrett's son is with General Petroleum Corp. and was recently transferred from California to Rock Springs, Wyo.

This suited A. F. Barrett fine because "it brings a couple of grandchildren closer." And it puts the family back in the Rocky Mountains, which, says Barrett, "is the best place in the U. S. to live."

Walter Rupp, John Wells, and **Orville White** have been named senior staff engineers for Esso Research & Engineering Co. Rupp has been with the company since 1930; White, since 1935; and Wells, since 1942.

Zuhayr A. Moghrabi, engineer with Socony Mobil Oil Co., Inc., in New York City, has been transferred to Beaumont, Tex., as process engineer at Magnolia Petroleum Co.'s refinery there.

Thomas J. Wintermute has been named district geologist at Corpus Christi, Tex., for Pure Oil Co. He succeeds **George A. Weaver,** who has been transferred to San Antonio, Tex., as district geologist.

C. R. Vegh Garzon has resigned as South American adviser for Universal Oil Products Co. to devote full time to Vegh & Vegh, consulting engineering firm in Montevideo, Uruguay. Vegh Garzon is founder and president of the South American Petroleum Institue. He was formerly manager of Uruguay's government-owned refinery at Montevideo.

George W. Watts, director of engineering research for Standard Oil Co. (Ind.), retired last week. Watts joined Indiana Standard in 1915. He has been chief engineer at the company's Whiting, Ind., refinery, chief engineer of the manufacturing department, and was named director of engineering in 1945. During World War II, Watts was on leave of absence from the company as supervisor of design and construction of the Oak Ridge, Tenn., nuclear energy plant which produced the first atomic bomb.

Personals

R. E. KEPKE

Robert E. Kepke has moved up to president of British - American Oil Producing Co. and its affiliate, Toronto Pipe Line Co., at Dallas, from his former position as executive vice president. **M. S. Beringer,** previously president and chairman of the board of the two firms, continues as board chairman. Kepke joined B.A. in 1941 as legal counsel in Texas. He was later named assistant to the executive vice president of the American firms, then a vice president and director of the parent firm, British American Oil, Ltd., and finally in 1953 executive vice president of the American companies.

E. G. Lanier has been transferred by Helmerich & Payne, Inc., from Liberal, Kans., to Woodward, Okla., as tool pusher.

H. W. Pope, head of Panhandle Eastern Pipe Line Co.'s land and geological department, has retired. Pope had been with the company 27 years.

Harold S. Wright, formerly associate engineer with Ohio Oil Co. in Grass Creek, Wyo., has joined Manufacturer's Light & Heat Co. in Easton, Pa., as pipeline engineer.

J. D. Poe has been named Loffland Brothers Co. contract representative in the West Texas-New Mexico division. He succeeds **H. J. Shumate,** who was recently transferred to New York as manager of foreign contracting.

Leo M. Wright, Houston division geologist for Sinclair Oil & Gas Co., has been transferred to Sinclair Oil & Refining Co. in Venezuela as assistant chief geologist. He will headquarter in Caracas. A graduate of the University of Tulsa and University of Missouri, Wright has been with Sinclair since 1952.

Don MacIntyre, section head in the technical service division at Esso Standard Oil Co.'s Bayway refinery, Linden, N. J., has been appointed head of petroleum technical service division there. He succeeds **Bill Robinson,** who was recently transferred to New York as manager of the economic and technical division, inland waterways department.

Philip W. Trumbo has rejoined Shell Oil Co. as exploitation engineer in Glendive, Mont. Trumbo has been on military leave.

R. L. Morton has retired as vice president, treasurer, and a director of Cities Service Gas Co. Morton has been with the Cities Service group since 1920.

L. A. Braden, district engineer with Tidewater Oil Co., has been promoted to area superintendent and transferred to Bakersfield, Calif., from Santa Fe Springs, Calif.

Harry G. Fair, chairman of Phillips Petroleum Co.'s operating committee, has been promoted to manager of the supply and transportation department. He succeeds the late D. M. McBride (see Deaths). **W. C. Hewitt,** vice chairman of the operating committee, moves up to replace Fair as chairman. Fair has been with Phillips since 1939.

H. G. FAIR

W. C. HEWITT

He was superintendent of the company's Kansas City refinery before becoming vice chairman of the operating committee in Bartlesville, Okla., in 1953. Hewitt was superintendent of operations and later assistant general manager of Phillips Chemical Co. before being named to the operating committee last January.

Howard L. Sanders, vice president and treasurer of Commercial Solvents Corp., has been named president of Northwest Nitro-Chemicals, Ltd., Canadian affiliate of Commercial Solvents. He succeeds **Thomas L. Brook,** who has resigned. Brook will continue as chairman of the board of New British Dominion Oil Co., Calgary.

Johnston Murray has resigned as president of Advanced Recovery Enterprises, Inc., Tulsa. Murray, former governor of Oklahoma, was vice president of Welex Jet Services, Inc., before its merger with Halliburton Oil Well Cementing Co. He was named as president of the newly organized Advanced Recovery Enterprises just last month (OGJ, Oct. 21, p. 84). Murray has not disclosed his plans for the future.

J. D. Fosque, European general manager for California Texas Oil Co., Ltd., has been elected a vice president. He will be responsible for all marketing and refining service activities for Caltex companies in Europe and Africa. Fosque was managing director of Caltex (India), Ltd., before becoming European general manager for the parent company in 1954.

Bert Arnold, tool pusher with Helmerich & Payne, Inc., has been transferred to Belfield, N. D., from Bowman, N. D.

Don Latimer, formerly head of the technical department at Esso Standard Oil Co.'s Baltimore refinery, has been transferred to Bayonne, N. J., as head of coordination at the refinery there.

C. Reid Carrington, formerly with The California Co. in Casper, Wyo., has joined Colorado Western Exploration Co. in Farmington, N. M., as manager of drilling operations and Four Corners area superintendent.

Ralph L. Lauderback, district geologist for Sunray Mid-Continent Oil Co. in Jackson, Miss., has been transferred to Tulsa. **Eugene Sigler,** geologist in Jackson, has moved to the company's Shreveport, La., office.

Bruce D. Carroll, engineer on the operations staff, manufacturing department, for Standard Oil Co. (Ohio), has transferred to Canfield Oil Co., Sohio subsidiary, as manager of operations. Carroll joined Sohio in 1950.

W. B. Cleveland, formerly manager of Creole Petroleum Corp.'s Amuay refinery in Venezuela, has been elected a director of Carter Oil Co. Cleveland has been with Standard Oil Co. (N.J.) affiliated companies since 1938. For the past 3 months he has been on special assignment for Standard-Vacuum Oil Co. in Indonesia and The Hague, Holland.

Lance L. Crozier has been named vice president of Canadian Kewanee, Ltd., newly organized subsidiary of Kewanee Oil Co. Crozier has been chief landman for Kewanee in Tulsa. He will headquarter in Calgary. **Paul G. Arnold,** northern district superintendent in Wichita, has been transferred to Calgary as production manager.

He Builds with SWECO

When this oil man needed a new refinery he faced a basic question: *How to get the best design and construction at lowest capital investment?* SWECO's answer made him a life-long client.

To build a new refinery for his supply of crude, he investigated many engineering and construction companies. One, he found, was just the right size: Not so big that his medium-size installation would get lost behind vast projects. But big enough to provide complete service. The picture was perfect: personal attention from a seasoned staff.

He investigated SWECO

SWECO engineering teams had designed and built complete refineries and refinery additions all over the world. They were licensed to engineer and construct plants for most modern refining processes. SWECO jobs, he found, were brought in on-target – regardless of location, weather, untrained labor or earth-girdling supply lines. And SWECO's reputation in the design and manufacture of petroleum processing equipment meant valuable knowledge and control of sources of supply.

He invited SWECO's proposal

Ingenuity and know-how were evident in every page of the SWECO proposal. It included field surveys and soil tests. Economic analyses and market studies. A provisional flow sheet showed the entire process graphically. Specifications, schedules, and plans were spelled out in detail. The proposal was wrapped up with a complete feasibility report.

He turned the job over to SWECO

From engineering and design, through purchasing and expediting, field construction–even through training personnel and putting the plant into operation–the SWECO engineering team took full responsibilty. It was a typical SWECO job: on-stream on-schedule. Now, the oil man is a typical SWECO client. Whatever his engineering and construction needs – complete plants or additional units for an existing installation – he builds with SWECO.

For the story on what SWECO Engineering and Construction teams can do for you in building refineries or petro-chemical plants . . . write for Bulletin E-7-317.

SWECO

Southwestern Engineering Company

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Engineers and Constructors . . . Manufacturers

Personals

Edmond V. Bond, Jr., Fort Worth, has joined Trunkline Gas Co. of Houston as superintendent of production operations. Bond has been with Southern Production Co. since 1948 as district engineer, district superintendent, and general superintendent. He is a graduate of Texas A. & M. College. Bond's post is a new one since the company only recently began production activities.

Edison E. Mincheff, assistant to the chief engineer of Great Lakes Pipe Line Co. in Kansas City, has joined Williams Brothers Corp. in Tulsa as engineer.

W. Robb Nisbet, manufacturing superintendent of Monsanto Chemical Co.'s plastics division styrene plant, has been transferred to Lion Oil Co. as manufacturing superintendent in charge of ethylene facilities at Texas City.

Earle B. Barnes has been appointed executive assistant on the staff of **Dr. A. P. Beutel,** Dow Chemical Co. vice president. Barnes will continue as director of organic research in Dow's Texas division. He has been with the company since 1940.

Lloyd E. Lundahl, Jr., chief engineer and assistant maintenance superintendent for Great Northern Oil Co. in St. Paul, has joined Grace Chemical Co. in Memphis as chief engineer. Lundahl was with Grace Chemical before joining Great Northern last year.

M. D. (Dale) Myers, senior geologist for Pan American Petroleum Corp. in Jackson, Miss., has resigned to become a consulting geologist there. Myers had been with Pan American since 1937. He was field geologist in Alabama and Florida before assignment to Jackson in 1948.

Cecil V. Brock, assistant district foreman at Norman, Okla., for Sinclair Oil & Gas Co., has been promoted to district foreman and transferred to Oklahoma City. **J. D. Anderson,** district foreman at Nowata, Okla., and **Dawson W. Engle,** district foreman at Wewoka, Okla., have exchanged jobs. Anderson is now assigned to Wewoka, Engle to Nowata.

Jack C. Fowler has joined Ohio Oil Co. as engineer in Garland, Wyo. Fowler was recently released from military service.

E. R. Freitas has been transferred from Shell Development Co.'s Emeryville, Calif., research center, to the Houston refinery of Shell Oil Co.

Kenneth A. Stierman, group supervisor for construction in Sohio Pipe Line Co.'s engineering section, has been named assistant superintendent of products pipelines. Stierman joined Sohio in 1951. He will headquarter in Fostoria, Ohio.

Gayle E. Stahl has been appointed manager of gas supply for Pioneer Natural Gas Co. He will headquarter in Amarillo, Tex. Stahl was formerly manager of gas purchases for Northern Natural Gas Co. and Permian Basin Pipeline Co., a position he has held since 1955.

Jennings Allen, Henry Grundig, and **Walter Sullivan** have been named section heads in Esso Engineering Co.'s office in The Hague, Netherlands. Allen will be in charge of inspection and expediting activities in Europe; Grundig will supervise contractor engineering; and Sullivan, field engineering.

Walter H. Helmerich, president of White Eagle Oil Co. and its drilling subsidiary, Helmerich & Payne, Inc., has been named to the executive committee of the International Petroleum Exposition. The next exposition will be held May 14-23, 1959, in Tulsa. Helmerich, an oil industry veteran, organized Helmerich & Payne in 1920.

George Levandusky has joined California Oil Co. as analytical chemist in Perth Amboy, N. J.

James N. Hicks has joined Union Producing Co. as production engineer in Houma, La.

B. L. Haynes, engineer with The California Co., has been transferred to Casper, Wyo., from Fort Collins, Colo.

Harland E. Newman has joined Lion Oil Co. division of Monsanto Chemical Co. in the company's El Dorado, Ark., research department. Newman, a graduate of the University of Texas, was formerly with Arion Oil Co. of California.

DEATHS

D. M. McBride, 54, Bartlesville, Okla., manager of Phillips Petroleum Co.'s supply and transportation department, died November 1 in New York. McBride joined Phillips in 1929 and has been manager of supply and transportation since 1955. He was manager of crude oil purchases before that time. On a business trip to New York, McBride was taken to the hospital with pneumonia 2 days before his death.

Harrison G. Davies, 78, president of the old Superior Oil Co. (Okla.), and later vice president of Socony Mobil Paint Products Co., died recently in Wauconda, Ill. Superior was merged with Sunray Oil Corp. in 1943. Davies retired from Socony in 1947.

A. L. McDowell, driller for Anschutz Drilling Co., was killed October 29 in an automobile accident near Douglas, Wyo. McDowell formerly lived in Vivian, La.

George G. Moore, 60, El Dorado, Ark., former Houston independent, died November 1 in Shreveport, La.

William E. Barrow, 77, Franklin, Pa., retired president of Joy Manufacturing Co., died October 28 in Franklin. Barrow became president of the Franklin Exchange Bank & Trust Co. after retiring from Joy in 1942.

Charles E. Finney, 67, retired president of Salt Lake Refining Co. and Salt Lake Pipe Line Co., died November 1 after a heart attack. Finney was a vice president of Standard Oil Co. of California before assignment to the Salt Lake companies, Calco subsidiaries, in 1948. He had been with Socal since 1919 and had served as general manager of manufacturing as well as vice president for industrial relations. He retired in 1953.

Walter C. Nelson, 72, San Antonio, Tex., oil producer, died October 26. Nelson began his oil career in the Spindletop field in 1902.

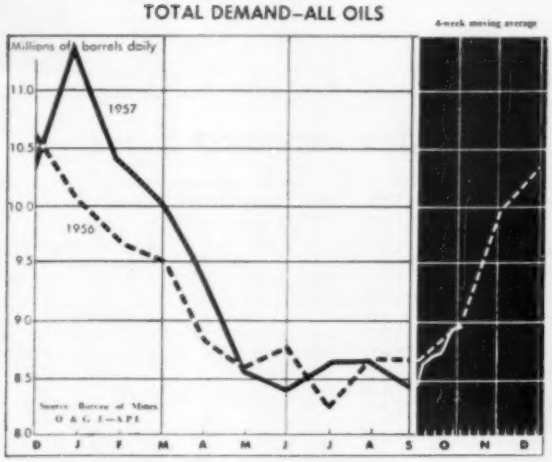
A. B. (Friday) Johnson of Hutchinson, Kans., independent operator in the Kansas area for 35 years, died recentely near Sand Springs, Okla., where he had gone to oversee a drilling operation. He was 55.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,720,200	DOWN	56,500	DOWN	305,940
Crude stocks	282,408,000	DOWN	2,470,000	DOWN	1,200,000
Completions	1,023	DOWN	94	DOWN	33
Refinery runs	7,580,000	DOWN	69,000	DOWN	273,000
Gasoline stocks	181,410,000	UP	2,122,000	UP	8,784,000
Kerosine stocks	34,264,000	DOWN	1,222,000	DOWN	971,000
Distillate stocks	174,772,000	DOWN	697,000	UP	16,087,000
Residual stocks	59,343,000	DOWN	122,000	UP	11,326,000
Four-product stocks	449,789,000	UP	81,000	UP	35,226,000
Total imports	1,485,400	DOWN	64,800	UP	8,700

TOTAL DEMAND—ALL OILS



Refinery Realizations Reflect Need for Higher Products Prices

CONTINUED WEAKNESS in gasolines on the West Coast, Gulf Coast, and East Coast with no improvement in the generally soft market conditions in distillate and fuel oil east of the West Coast summarizes domestic refined-product trends over the past week.

Socony Mobil Oil Co., led, in a ½-cent reduction in wholesale gasoline prices at many points along the eastern seaboard not previously reduced. The company explained that the reductions were due to price weakness at refinery suppliers in the East and Gulf coasts. Refinery gasoline prices were reduced fractionally in the Los Angeles area.

The Gulf Coast gasoline cargo quotations were unchanged following the ¼-cent reductions of the previous week. But the lower prices had not stimulated demands and spot cargoes were offered under the generally quoted market levels.

The slow coastwise and export gasoline demands have increased barge shipments up the Mississippi River from gulf refineries. This has disturbed relatively firm markets for gasolines at points accessible to the river generally served by Mid-Continent and Middle West refineries.

The seriousness of the product price situation is apparent from some of the third-quarter statements of large oil companies whose earning reports show reductions over the third quarter of last year. The explanation of Atlantic Refining Co., with major refineries at Point Breeze, Pa., and Atreco, Tex., is representative.

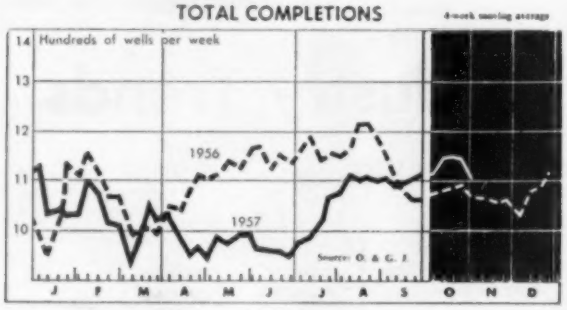
The company explained that its reduction in profits was partially due to reduced crude-production allowables and higher labor costs, but also listed "a sharp decline in the margin between selling prices of products and purchase price of crude oil."

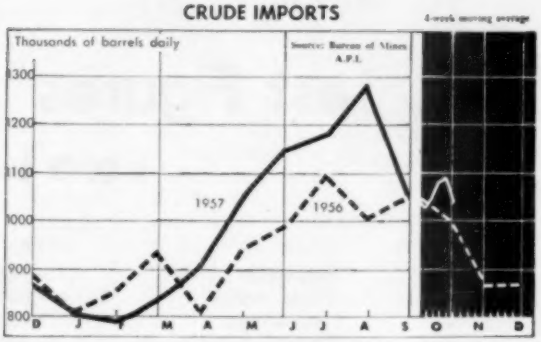
Other companies which have to buy a part of their refinery crude-oil supplies have also pointed out that refinery realizations have dropped to the point where they have lost all of the increases which materialized early in the year after the 25 to 40-cent increase in posted crude-oil prices.

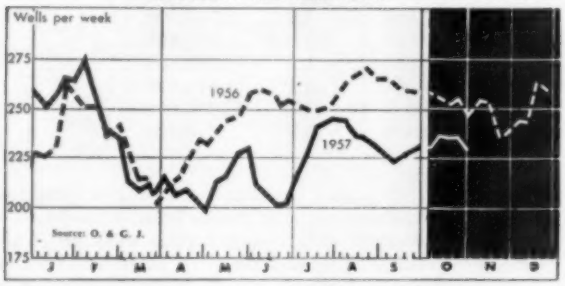
The monthly realization charts appearing in this issue (page 278) show the trends in recent years. The comparative data reveal that the Mid-Continent realization dropped from $4.23 per barrel in February to $3.80 in late October (preliminary figure) a decline of 43 cents. Because of a comparatively better gasoline market the decline in the Gulf Coast realization for the same period was 23 cents.

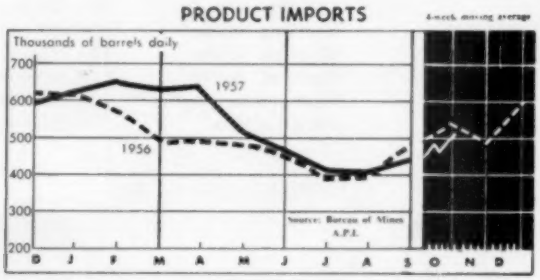
The sharp drop in Mid-Continent realizations has been largely due to the price declines in the heavier products—distillates and fuel oil. Of the 43-cent decline, 18.6 per cent was due to gasoline, 7 per cent to kerosine, 39.5 per cent to distillate, and 34.9 per cent to fuel oil.

These developments have brought a serious operating situation to many refineries, particularly those which purchase a large part or all of their crude-oil supply. This, in turn has spawned local price concessions in the delivered price for crude oil at scattered points. There is surplus crude oil in some areas with unconnected wells and a few sellers are willing to give minor concessions in delivered prices for crude oil rather than bring about a situation where small and medium-sized refineries would be forced to shut down or curtail operations until plant realizations are on a more favorable basis. In the coastal areas it is hoped that the reduction in imports under a government program will shortly tighten both the crude-oil and refinery markets.







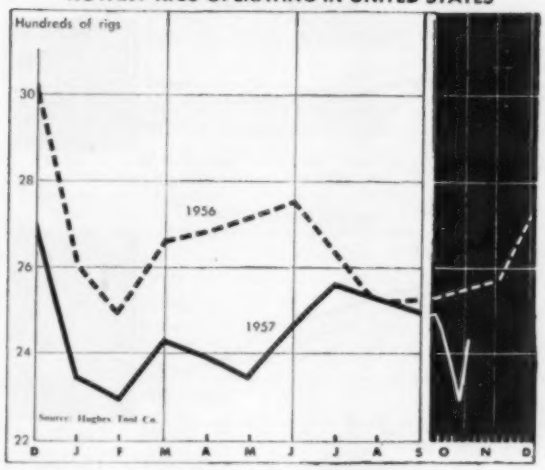


WEEKLY WELL COMPLETIONS . . . WEEK ENDED NOVEMBER 2, 1957

	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1957	1956	Total	Crude	Cond.	Gas	Dry	1957	1956
Alabama	2	0	0	0	2	0	5,488	69	‡95	2	0	0	0	2	23	‡42
Arkansas	27	21	0	0	6	0	88,075	936	794	3	0	0	0	3	172	160
California	38	29	0	0	9	0	171,678	1,853	1,859	6	0	0	0	6	443	433
Colorado	25	3	0	4	18	0	138,574	721	1,016	16	0	0	1	15	473	545
Illinois	64	28	0	0	36	0	146,773	2,268	3,320	17	0	0	0	17	535	641
Indiana	24	8	0	0	16	0	45,741	568	586	3	0	0	0	3	112	120
Kansas	85	39	0	7	36	3	314,024	3,552	4,205	6	1	0	0	5	702	914
Kentucky	25	3	0	0	22	0	29,077	1,264	1,603	5	0	0	0	5	254	373
Louisiana	81	40	3	6	32	0	646,786	3,256	3,206	10	2	0	1	7	575	647
North	28	16	0	2	10	0	99,599	1,200	1,416	1	0	0	0	1	161	219
South	33	15	3	0	15	0	352,409	1,468	1,450	5	1	0	0	4	338	364
Offshore	20	9	0	4	7	0	194,778	588	340	4	1	0	1	2	76	64
Michigan	17	6	0	6	5	0	52,173	379	376	4	0	0	0	4	132	144
Mississippi	9	5	0	0	4	0	75,457	329	374	2	0	0	0	2	166	182
Montana	8	4	0	0	4	0	34,480	350	394	2	0	0	0	2	138	148
Nebraska	8	2	0	0	6	0	46,772	753	810	3	0	0	0	3	412	403
New Mexico	32	14	0	13	5	0	156,263	1,812	1,616	4	2	0	0	2	236	229
Northwest	16	2	0	13	1	0	67,735	770	714	1	1	0	0	0	91	80
Southeast	16	12	0	0	4	0	88,528	1,042	902	3	1	0	0	2	145	149
New York	18	9	0	0	0	9	18,500	390	....	0	0	0	0	0	7	....
North Dakota	3	1	0	0	2	0	15,612	239	225	2	0	0	0	2	108	67
Ohio	22	11	0	7	3	1	56,907	949	907	0	0	0	0	0	16	12
Oklahoma	132	65	2	3	54	8	434,663	5,406	6,994	20	3	0	1	16	636	742
Pennsylvania	0	0	0	0	0	0	0	519	†957	0	0	0	0	0	41	‡30
Texas	369	202	4	12	150	1	1,433,334	18,315	18,591	74	2	2	1	69	4,344	4,745
Dist. 1	25	7	0	0	18	0	68,331	1,049	*2,658	12	0	0	0	12	359	*925
Dist. 2	16	4	2	3	7	0	73,538	652	*2,215	4	0	2	0	2	228	*729
Dist. 3	25	7	2	1	14	1	140,574	1,425	....	2	0	0	0	2	399	....
Dist. 4	18	6	0	4	8	0	113,643	1,174	....	4	0	0	0	4	376	....
East	37	25	0	0	12	0	144,698	1,150	976	9	0	0	0	9	329	354
Dist. 7-B	36	8	0	1	27	0	141,880	2,477	....	19	0	0	1	18	849	....
West	113	91	0	0	22	0	501,741	5,182	4,986	11	1	0	0	10	732	784
Dist. 9	86	45	0	0	41	0	196,846	4,004	*6,634	11	0	0	0	11	979	*1,848
Dist. 10	13	9	0	3	1	0	52,083	1,202	1,122	2	1	0	0	1	93	105
Utah	10	5	0	1	4	0	50,923	200	105	4	0	0	0	4	101	63
West Virginia	16	4	0	10	2	0	37,568	587	582	1	0	0	1	0	29	20
Wyoming	6	2	0	1	3	0	36,597	722	750	1	0	0	0	1	247	230
Misc. (S. D.)	2	0	0	0	2	0	7,062	116	71	2	0	0	0	2	99	64
Total U. S.	1,023	501	9	70	421	22	3,995,571	45,553	49,301	187	10	2	5	170	10,001	10,954
Total prev. week	1,117	565	24	87	430	11	4,655,652	....	....	229	13	3	8	205	....	....
Cum. 1957	45,553	23,509	482	3,279	17,357	926	188,429,967	....	....	10,001	998	87	338	8,578	....	....
Western Canada	61	30	0	10	20	1	297,531	2,570	2,673	18	2	0	2	14	726	....

*Districts: 2 & 3, 1 & 4, 9 & 7-B, formerly combined. †Incl. New York. ‡Incl. Florida and Georgia.

ROTARY RIGS OPERATING IN UNITED STATES



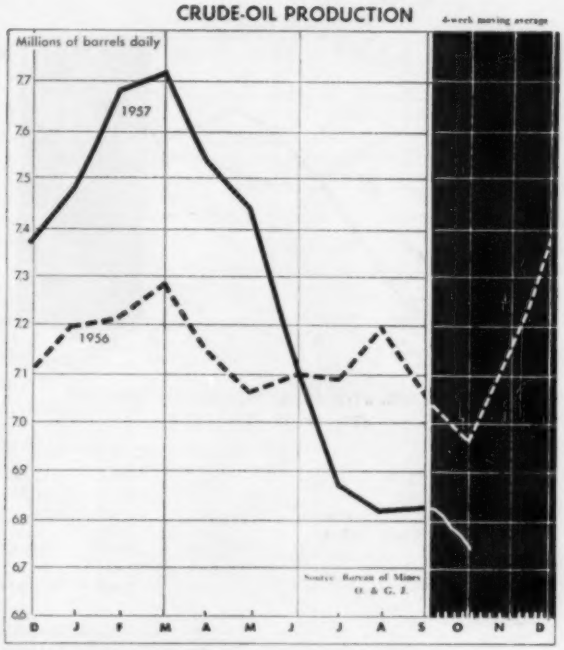
ACTIVE ROTARY RIGS*

Area—	11-4-57	10-28-57	10-21-57	11-5-56
Alabama	6	6	5	8
Arkansas	26	23	30	18
Arizona	1	1	1	...
California	82	84	87	111
Colorado	54	52	56	65
Florida	1	1	1	4
Georgia	...	...	...	...
Idaho	...	...	...	...
Illinois	60	50	47	77
Indiana	5	7	7	7
Iowa	2	2	2	1
Kansas	153	137	155	167
Kentucky	10	11	8	8
Louisiana	394	407	427	453
North	58	63	56	71
South	259	264	284	382
Offshore	77	80	87	(†)
Maryland	1	1	1	...
Michigan	13	13	11	15
Missouri	...	...	...	1
Mississippi	48	41	43	41
Montana	38	37	38	29
Nebraska	29	26	24	22
Nevada	...	...	...	1
New Mexico	138	136	144	129
New York	...	...	...	...
North Dakota	42	41	37	27
Ohio	1	1	1	...
Oklahoma	261	230	240	258
Oregon	...	1	1	...
Pennsylvania	13	13	13	6
South Dakota	2	1	1	...
Texas	909	839	859	1,002
Gulf Coast	163	159	173	235
Offshore	6	7	4	(‡)
West	369	338	350	383
North	321	294	287	322
East	50	41	45	62
Tennessee	...	...	...	...
Utah	57	54	62	27
Washington	1	1	1	1
West Virginia	3	3	3	3
Wyoming	82	78	78	61
Virginia	...	...	...	...
Total United States	2,432	2,297	2,383	2,542
Western Canada	163	179	181	252
Grand total	2,597	2,479	2,567	2,794

*Hughes Tool Co. †Included with South Louisiana. ‡Included with Texas Gulf Coast.

CRUDE-OIL PRODUCTION

4-week moving average

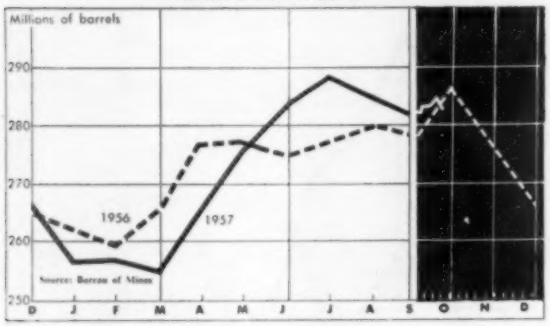


DAILY AVERAGE PRODUCTION FOR WEEK

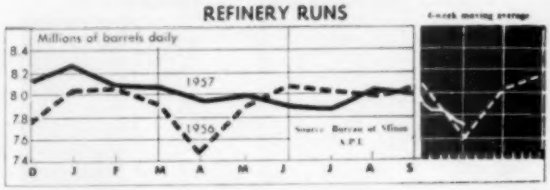
	November 2, 1957			Oct. 26
	Crude oil	Lease condensate	Total	total
Alabama	17,050	.....	17,050	16,950
Arkansas	79,825	175	80,000	80,100
California	935,600	.....	935,600	934,800
Colorado	146,400	.....	146,400	145,800
Eastern	52,600	.....	52,600	53,200
Florida	1,250	.....	1,250	1,250
Illinois	226,900	.....	226,900	232,000
Indiana	34,900	.....	34,900	37,200
Kansas	†323,500	.....	†323,500	354,600
Kentucky	45,800	.....	45,800	43,400
Louisiana	725,575	77,500	803,075	803,100
North	110,575	2,500	113,075	113,100
South	615,000	75,000	690,000	690,000
Michigan	27,600	.....	27,600	26,900
Mississippi	99,800	4,500	104,300	104,300
Montana	77,900	.....	77,900	75,000
Nebraska	55,050	.....	55,050	54,550
Nevada	150	.....	150	150
New Mexico	249,000	4,300	253,300	253,300
North Dakota	27,700	.....	27,700	29,350
Oklahoma	†551,000	.....	†551,000	562,100
Texas	2,595,000	55,100	2,650,100	2,650,100
Dist. 1	48,000	500	48,500	48,500
Dist. 2	116,000	8,800	124,800	124,800
Dist. 3	374,000	26,800	400,800	400,800
Dist. 4	197,000	6,300	203,300	203,300
Dist. 5	32,000	300	32,300	32,300
Dist. 6	108,000	5,900	113,900	113,900
East Texas field	155,000	.....	155,000	155,000
Dist. 7-B	143,000	75	143,075	143,075
Dist. 7-C	138,000	3,875	141,875	141,875
Dist. 8	982,000	1,400	983,400	983,400
Dist. 9	200,000	600	200,600	200,600
Dist. 10	102,000	550	102,550	102,550
Utah	14,125	.....	14,125	12,600
Wyoming	291,700	.....	291,700	305,750
Others	‡200	.....	‡200	‡200
Total U. S.	6,578,625	141,575	**6,720,200**	6,776,700
Change from previous week, down			**56,500**	
Canada	†432,650	.....	†432,650	†464,000
Total U. S. production, January 1-November 2			2,208,489,850 bbl.	
Same period last year (crude plus cond.)			*2,188,403,500 bbl.	

*Includes 37,670,500 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

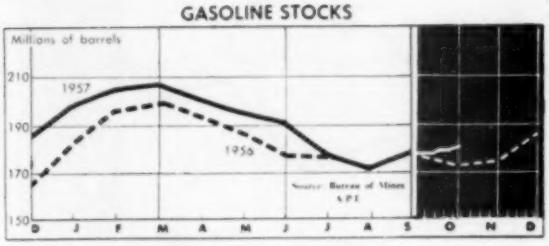
CRUDE-OIL STOCKS



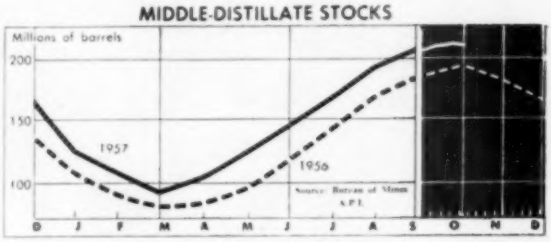
REFINERY RUNS



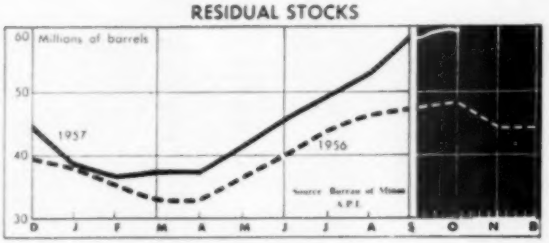
GASOLINE STOCKS



MIDDLE-DISTILLATE STOCKS



RESIDUAL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	10-26-57	10-19-57	10-27-56
Pennsylvanian Grade	3,155	3,131	2,449
Other Appalachian	1,771	1,821	2,311
Illinois, Indiana, and Michigan	10,983	10,904	11,143
Nebraska and North Dakota	2,900	3,015	2,311
Kansas	10,264	10,417	10,470
Oklahoma	20,933	20,441	25,162
Arkansas	2,748	2,341	2,934
Louisiana	19,421	19,258	17,397
North	3,222	3,045	2,734
South	16,199	16,213	14,663
Mississippi, Ala., and Fla.	2,757	2,538	3,010
New Mexico	9,905	9,917	9,155
Texas	125,702	128,103	128,303
East Texas	9,638	9,365	9,231
West Texas	58,522	59,555	63,219
Texas Gulf	24,245	25,356	23,976
Other Texas	33,297	33,827	31,877
Wyoming	14,531	15,145	16,890
Other Rocky Mountain	6,394	6,584	6,475
California	32,382	32,568	19,453
Foreign	†18,562	18,695	16,145
Total	282,408	284,878	283,608

*Bureau of Mines. †Includes 4,908,000 bbl. in California.

A.P.I. REFINERY REPORT, NOVEMBER 1, 1957

(Thousands of barrels)

District—	Daily avg. runs	Daily average production— Gaso.*	Kero.	Dist.	Resid.	Stocks‡— Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, November 1956— Daily avg. runs	Daily average production— Gaso.*	Kero.	Dist.	Resid.
East Coast	1,110	489.7	38.4	321.3	162.2	43,867	13,793	67,140	14,198	1,141	446.6	36.0	310.5	205.0
Appalachian:														
District 1	106	46.0	4.1	26.7	8.9	4,724	595	3,819	610	105	40.9	6.3	27.0	6.3
District 2	113	46.3	7.4	18.3	14.4	2,502	522	1,462	212	101	55.5	6.1	18.7	13.0
Ind., Ill., Ky.	1,324	726.0	67.3	289.0	149.4	30,889	7,339	24,887	5,985	1,429	742.3	78.0	295.3	193.1
Minn., Wis., Dak.	77	40.9	5.2	16.9	7.1	6,249	1,631	8,221	367	100	49.9	8.1	25.5	9.0
Okla., Kans., Mo.	664	369.4	9.0	169.3	24.2	14,023	1,878	14,244	1,156	694	379.0	17.1	176.1	33.8
Inland Texas	275	215.1	6.3	45.4	25.3	6,819	540	2,783	2,098	267	186.1	8.3	54.6	19.5
Texas Gulf Coast	1,738	896.3	101.3	379.0	192.4	24,721	3,749	20,032	7,383	1,960	896.7	135.8	490.8	252.1
La. Gulf Coast	587	348.0	22.0	180.8	41.9	11,410	2,695	9,282	1,494	667	368.9	68.5	165.9	56.1
N. La. and Ark.	79	39.4	3.0	20.3	5.1	4,257	783	2,302	207	103	42.2	9.9	22.2	6.9
Rocky Mountain:														
New Mexico	28	14.6	0.4	6.1	3.4	441	14	103	70	27	13.4	0.6	5.2	3.5
Other Rocky Mtn.	256	132.9	4.3	63.6	31.4	5,382	355	3,072	958	268	136.5	4.4	62.4	37.2
West Coast	1,223	496.0	3.0	188.6	384.9	26,126	370	17,425	24,605	1,170	501.3	4.5	187.3	346.8
Nov. 1, 1957	7,580	3,860.6	271.7	1,725.3	1,050.6	181,410	34,264	174,772	59,343	8,032	3,859.3	383.6	1,841.5	1,182.3
Oct. 25, 1957	7,649	3,907.1	286.7	1,732.3	997.3	179,288	35,486	175,469§	59,465	.....	.....	.....	.....	.....
Nov. 2 1956	7,853	3,802.9	358.1	1,782.4	1,119.3	172,626	35,235	158,685	48,017	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Revised.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.50-11.75
Premium (98 octane)	14.25-14.50
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.75-11.00
Regular (92 octane)	11.00-11.25
Premium (97 octane)	12.50-12.75
Premium (98 octane)	12.75-13.00
California (rack):	
★ Regular (88 octane)	12.2
★ Premium (96 octane)	14.8
★ Premium (98 octane)	15.0
Caribbean area (cargoes):	
Regular (87 octane)	10.625
Premium (93 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.50-10.00
Diesel oil (58 d.i. and above)	9.125-9.75
Distillate No. 1	9.125-9.75
Distillate No. 2	8.50-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	8.75-9.50
Distillate No. 2	8.75-9.50
New York Harbor (barges):	
Kerosine 41-43	10.75
Distillate No. 2	10.25
Diesel fuel, 48-52 d.i.	10.55
Caribbean area (cargoes):	
Distillate No. 2	9.00

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.60-1.80
Gulf Coast (cargoes):	
Bunker C fuel	$2.50-2.75
New York Harbor (barges):	
Bunker C fuel	$2.95
Caribbean (cargoes):	
Bunker C	$2.55
California (rack):	
Bunker C fuel, Los Angeles	$2.85-3.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	28
200 vis. neutral (180 at 100°), 25 p.t.	26

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour) ($)
14-14.9	$2.67	....	....	....	....
15-15.9	2.71	....	....	....	$1.81
16-16.9	2.74	....	....	....	1.86
17-17.9	2.78	....	....	....	1.91
18-18.9	2.82	....	....	....	1.96
19-19.9	2.85	....	....	....	2.01
20-20.9	2.89	$2.75	....	$2.62	2.06
21-21.9	2.93	2.77	....	2.64	2.11
22-22.9	2.97	2.79	....	2.66	2.16
23-23.9	3.01	2.81	$3.44	2.68	2.21
24-24.9	3.05	2.83	3.46	2.70	2.26
25-25.9	3.09	2.85	3.48	2.72	2.31
26-26.9	3.13	2.87	3.50	2.74	2.36
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma, part of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low cold test Gulf Coast. ‡Sour. §Most buyers are posting Wyoming sour in two schedules, 15°-26.9° and 27°-40°.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, July 26, 1957.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.65
Middle District	4.47
Southwest Pennsylvania	4.18
West Virginia	4.00
Buckeye Grade	4.00
Zanesville Grade	3.04
Illinois Basin	3.15
Canada:	
Leduc-Woodbend	2.74
Redwater (Alta.)	2.63
Smiley (Sask.)	2.40
Pembina	2.61

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.38
Bachaquero, flat, Las Piedras*	2.23

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 36.0°-36.9°, Fao	2.00
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.59
Iraq, 36.0°-36.9°, Tripoli, Banias	2.59
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., clean (USMC—25%)	$2.14
★ Gulf-U.S.N.H., dirty (USMC—30%)	2.00
Carib.-U.S.N.H., dirty (USMC—55%)	1.22
P.G.-Mediterranean area, dirty (Scale—55%)	....

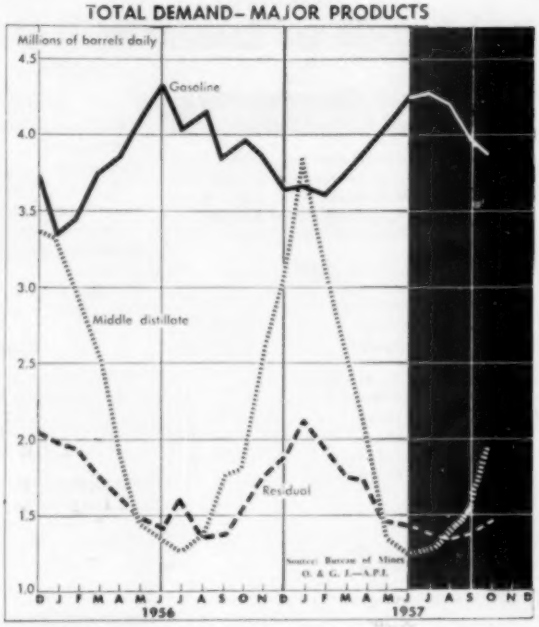
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

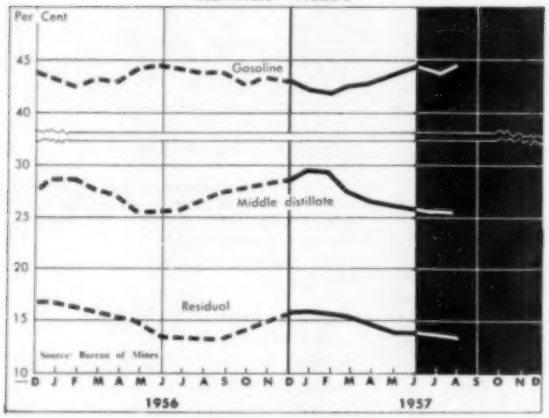
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
October 1957*	3,870	3,915	181,410
September 1957*	3,975	4,070	177,400
August 1957	4,262	4,042	174,031
November 1956	3,862	3,859	174,808
October 1956	3,970	3,727	172,798
KEROSINE			
October 1957*	325	265	34,260
September 1957*	220	275	36,000
August 1957	164	252	34,576
November 1956	434	384	34,329
October 1956	294	356	35,667
DISTILLATE			
October 1957*	1,620	1,740	174,770
September 1957*	1,310	1,770	170,425
August 1957	1,175	1,806	159,124
November 1956	2,105	1,841	151,517
October 1956	1,521	1,772	158,871
RESIDUAL			
October 1957*	1,475	1,050	59,340
September 1957*	1,380	1,125	57,950
August 1957	1,367	1,089	52,645
November 1956	1,769	1,182	44,590
October 1956	1,532	1,082	48,400

*Preliminary. †Thousands of barrels.

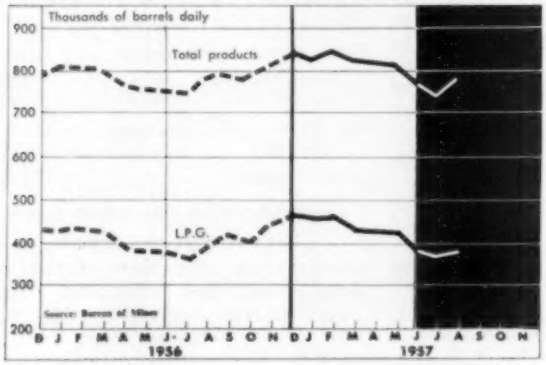
TOTAL DEMAND–MAJOR PRODUCTS



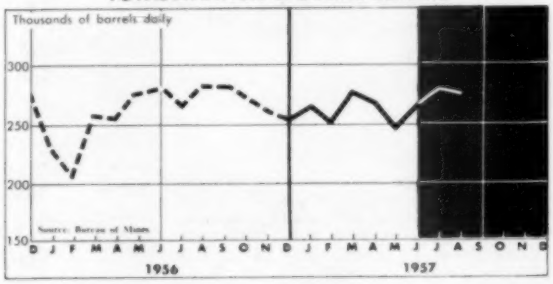
REFINERY YIELDS



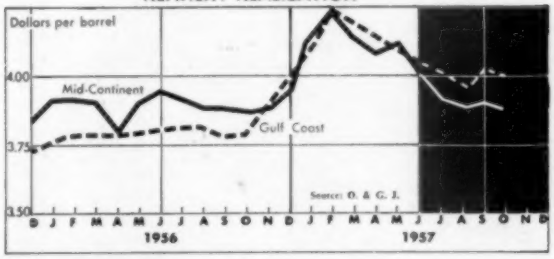
NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



TOTAL AVIATION GASOLINE DEMAND



REFINERY REALIZATION



REFINERY REALIZATION

	Oct.* 1957	Sept.* 1957	Aug. 1957	Oct. 1956
Mid-Continent	$3.88	$3.92	$3.86	$3.87
Gulf Coast	4.00	4.03	3.99	3.79

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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D-8 CATERPILLAR TRACTOR, Dozer and #70 Caterpillar Scraper. Bought new in 1951. Low hours. Like new condition. Located Matador, Texas. Rock Island Oil & Refining Co., Inc., 321 West Douglas Avenue, Wichita 2, Kansas.

FOR SALE: One 480 barrel welded tank. 12 feet by 24 feet Weight: 12,100 lbs. Bottom: ¼". Sides ¼". Built by Lincoln Tank Company in March, 1950. Contact Olin Calvin. P. O. Box 655, Olney, Texas.

FOR SALE at Ponca City refinery, 1—slightly used M. W. Kellogg hydro-ejector for inserting and removing heat exchanger tube bundles. Price $1150.00. Cities Service Oil Company—Patridge—Bartlesville, Oklahoma.

COMPLETE 600 KW Generating Plant. 2—300 KW Worthington-G.E. Gas Engine Generating Units. 1—Nelson Electric Cubical Switchboard. 2—Happy Engine Coolers, all Auxiliaries. 1—Steel Building 36'x40'x12'. MAX E. LANDRY, INC. P. O. Box 2238, Tulsa. Phone RI 7-1394.

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Box K-405, The Oil and Gas Journal, Tulsa, Oklahoma.

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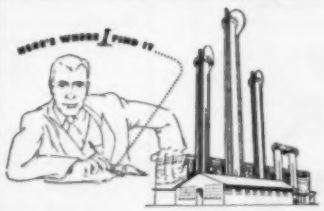

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Details of the lease offering and filing of bids may be obtained by addressing an inquiry to the General Superintendent, Navajo Indian Agency, Attention: Branch of Realty, Window Rock, Arizona.

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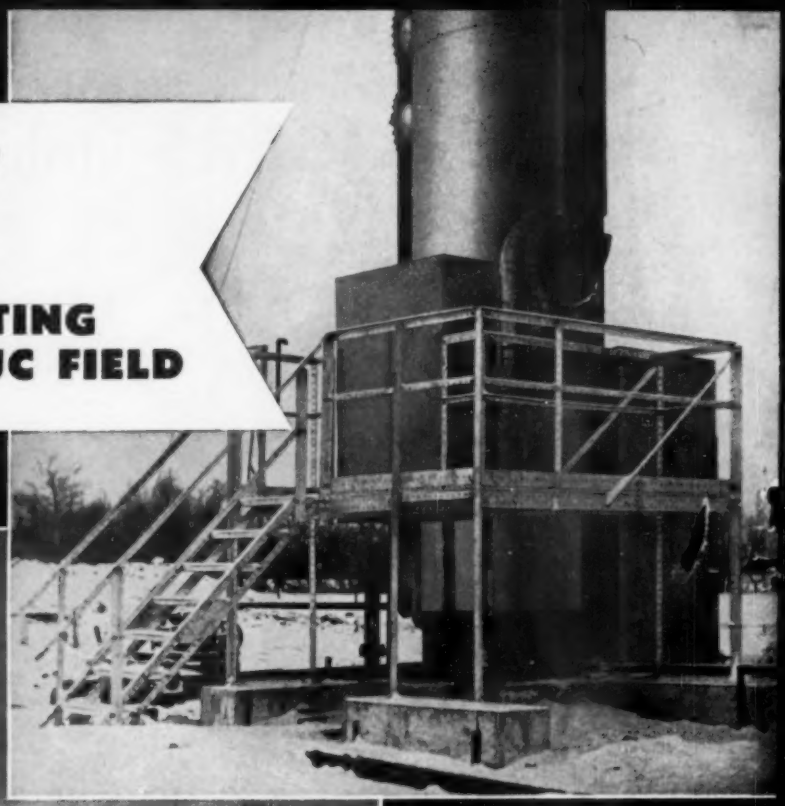
National

TANK ENGINEERS SOLVE CRUDE HEATING PROBLEMS IN LEDUC FIELD



SOUTH LEDUC—4' x 27½' "YCP" 15# National Treater

LEDUC—4 Hi-500 Bbl. National Bolted Steel Tanks
1 6' x 20' "YIWP" 15# National Treater
1 2C, 2½' x 13' 125# National Separator
1 NC, 2' x 6' 125# National Separator

Instead of expensive boiler installations, many Canadian operators are turning to National Treaters to maintain crude pour point under extreme weather conditions. Temperatures as low as 60° below zero, inadequate water supplies, frequent shut-downs, oil loss through steam heat evaporation were the difficulties that led National engineers to a practical and economical solution.

By re-designing piping hook-ups and circulation lines, by putting crude in at the bottom of the tanks and by installing a National Treater instead of a boiler, all difficulties of maintaining pour point have been eliminated. Crude is circulated from tanks through treaters. Unlike boilers, National Treaters require very little water.

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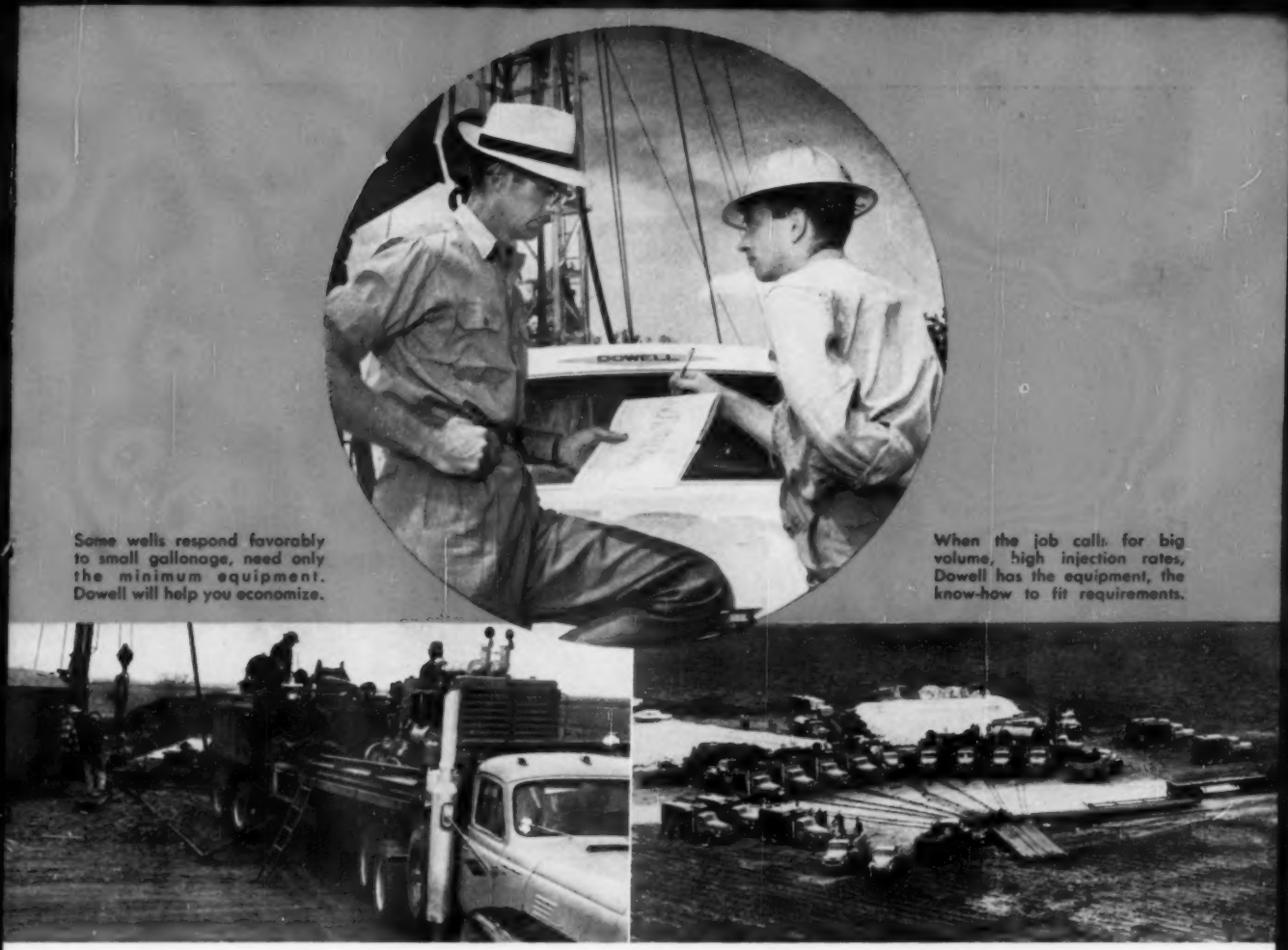

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You can depend on your Dowell engineer to recommend the type and size of treatment that's best for your well . . . the treatment that will give you the most returns for your treatment dollar. For information or service call any of the 165 Dowell offices in the U. S. and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

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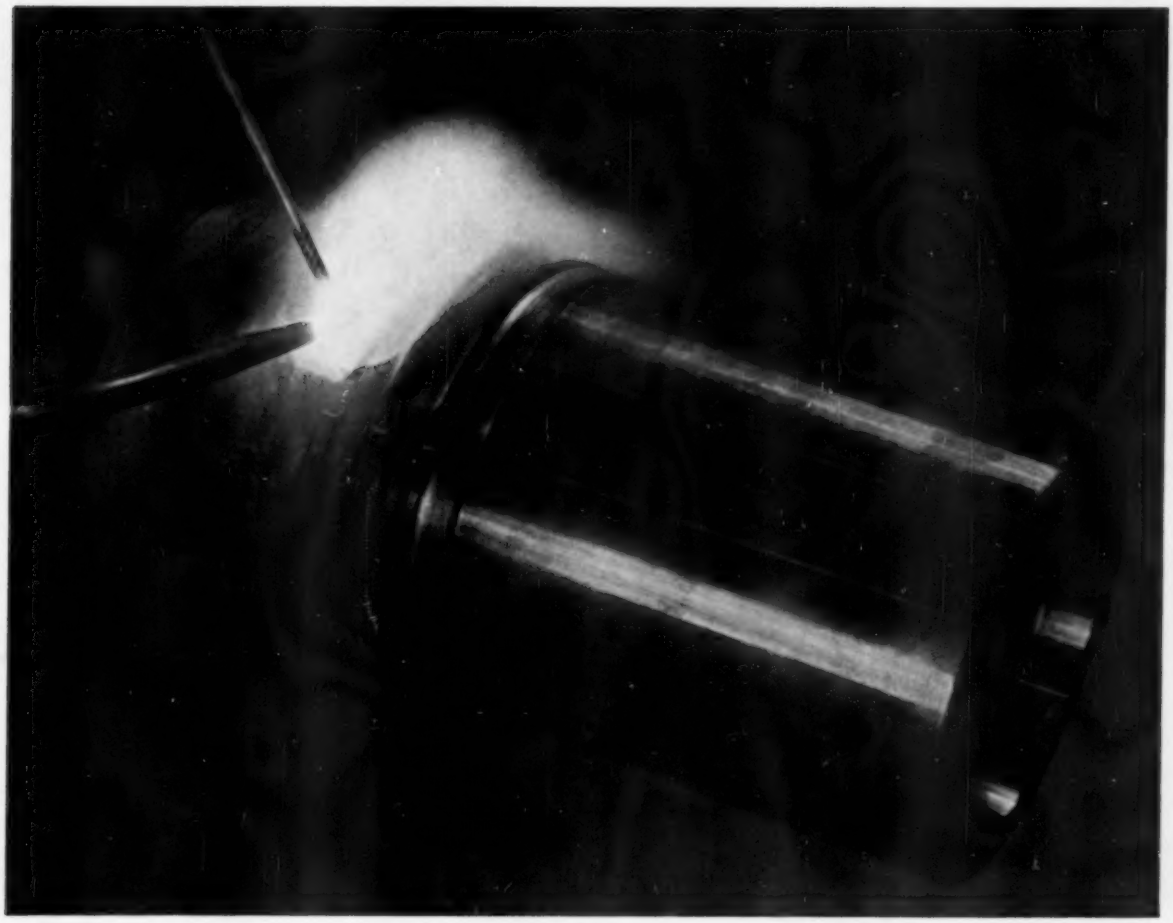

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